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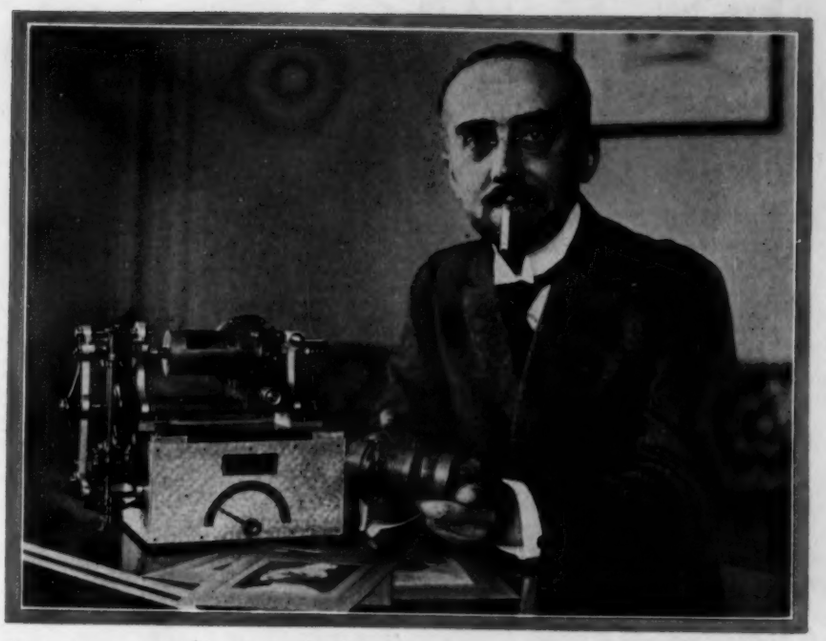

Edward Belin and his wonderful invention, the Telephotographis, by which photographs are transmitted by telephone hundreds of miles from city to city. Belin is a French scientist and began his experiments in 1908.

Photographs transmitted a thousand miles by wire.

To the left is a photograph transmitted by telephone from Chicago to New York. To the right is the first photograph transmitted by wire in America, sent from St. Louis to the New York World.

—Photos by Keystone.

Telephotographis sending apparatus to the left. As the cylinder revolves a little electrical needle passes over every bit of the picture, which is in relief. Vibrations are thus set up. These vibrations are carried over the telephone wire and cause a tiny illuminated mirror at the receiving station to oscillate. These oscillations are passed through various magnifying and diminishing lenses to a photographic plate.

TELEPHONE ENGINEER

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Editorial Mention

A Move in the Right Direction

A society has been formed in New York City to encourage reduction in length and number of telephone calls. Whoever may be responsible for beginning this agitation, it is along a line where reform is a crying need. Much of the criticism which is heaped upon telephone companies for inefficiency in service should, as a matter of fact, be charged at the door of those who abuse rather than use this service. There is seldom any need for protracted conversation over the phone. There are, of course, business discussions which demand a certain amount of time and detail for their arrangement, but the ordinary friendly call could be shortened without injury. The lavishness of the American with his tongue has brought about the shortage and increased expense in telephone service.

Romance of the Telephone

There is material for the building of a melodrama in a story which comes from Lexington, Ky., in which the telephone figures. While Miss Fannie Brasher, telephone operator at Middlesboro, was talking on the wire after midnight to a girl operator at Pineville, 20 miles away, she whispered, "Someone's breaking into the office." The Pineville girl responded, "Connect me with your police station." As the connection was made the Pineville girl heard Miss Brasher scream. The station is a block from the telephone office and when officers reached the place Miss Brasher was found on the floor unconscious with a big gash in her head and clinched tightly between her teeth were many strands of red hair. When Miss Brasher recovered her senses she declared a negro had attacked her. A posse's all-day quest was futile, and then Miss Brasher's attention was called to the red hair she had in her mouth. She then admitted that James Thompson, a sweetheart she had jilted, had committed the assault, after telling her he intended to kill her.

A warrant charges him with assault with intent to kill. He cannot be found. The name of the Pineville girl who saved Miss Brasher's life is not given in dispatches from there. Miss Brasher will recover.

A great many romantic things happeu in which the telephone figures, and they will continue to happen. For the telephone goes practically everywhere, and practically everybody uses it.

SUCCESS TALKS
INDUSTRY
By S. A. CHANDLER

In order to rise above the average level of his fellow beings, man must show industry—not ordinary industry that results in ordinary production, but extraordinary industry which accomplishes more or better results.

The man who does only what any other man working in the same shop or in the same industry does, is thought of as one of many, all of equal value—as just one little cog in the big industrial wheel.

But if he would rise out of the cog class and become known as one worth more than the average, he must do a little more work than the average, or his work must be better done. In doing so he not only increases the amount or the quality of his production, but he also increases his value by stimulating others to follow his example. He creates a competitive spirit among his fellow workers which increases production.

In this way the attention of those who can and will reward extra service with extra pay will be directed to him in a most favorable light. They will consider his extraordinary industry as worthy of extraordinary consideration. They will not only appreciate what he accomplishes with his own brain or his own hands, but will realize the full value of his example on the other workers in their establishment, and will appraise him at his true worth.

His repeated advancements will depend largely upon his ability to keep up this impression.

(Copyright, 1920, by S. A. Chandler)

Mr. Edison's Celestial Telephone

Until Mr. Edison confirms the statement over his own signature, conservative readers will remain skeptical of the truth of a report that he is making progress toward the invention of mechanical apparatus to bring about ready communication with the spirit world.

The trouble with the New York correspondent's optimistic prediction is that it is too good to be true. Only a moment of reflection serves to show what revolutionary reform of this old world would be accomplished should Edison really provide us with telephonic communication with the departed. With the perfection of the very first instrument, perennial nuisance, the politician who continually spouts about what Lincoln or Washington would do if he were president today, would be driven into silence. A long distance call through the Heavenly exchange would immediately settle all controversy.

And what dark pages of history would be cleared up, what age-old controversies among savants as to the motives that prompted certain deeds of statesmanship, what stories that dead men could not tell! For years historians and archaeologists would keep the celestial lines so busy that common folk would have no opportunity for friendly chats with the more recently departed.

No, no, the spiritphone plainly is not for this age. Omniscience is not intended as an attribute of man, and that is precisely what this device would lead to. Perhaps it is as well, after all, for cherished illusions would have to go along with perplexing doubts once the past were fully exposed. Why, just the thought of the seraphim reduced to the status of hello girls is enough to make one willing to relinquish the ambition.

Speak Gently to the Operator

Sundays and holidays, rain or shine, early and late, the telephone operator is always on the job. The average man or women fails to appreciate the faithful service that is rendered by the telephone girl and believing she is an impractical sort of a person forget themselves and vent their ill humor on her or blame her for their own mistakes. The telephone girl is entirely human and working on a job that necessitates quick but accurate attention every minute. Remember this the next time you are tempted to "call down" central.

The Telephone in Foreign Countries

Items of General Interest to Telephone Men From All Parts of the World

By G. P. BUNKER.

ITALY

The Italian government is occupied with a scheme to establish telephonic communication with Albania (telegraphic connection already existing). The projected line will start from Rome and will be carried under the sea to Valona, and end eventually at some important Greek center. The exact length of the existing Otranto-Valona telegraphic cable is 99 km., but a new point of departure will probably have to be chosen for the telephone line, the length of which, in consequence, may be about 106 kilometers. The Societa Pirelli has been instructed to draft the necessary plans.

* * *

GERMANY

On April 1, 1914, direct telephone communication between Berlin, Frankfort-on-Main and Milan, through the Simplon Tunnel, was opened. The distance, 1,350 kilometers, was longer than that between Berlin and Paris, 1,198 kilometers. On the outbreak of war telephone communication between Germany and Italy was broken off. The direct line between Berlin and Milan was utilized thenceforth for the development of telephone communication between Berlin, Frankfort-on-Main and Switzerland, and the traffic assumed extraordinary proportions. When relations between Germany and Italy were resumed in 1919, it was found that many difficulties had to be overcome before the telephone line between Berlin and Milan could be restored to its original use. The Swiss Telegraph Administration demanded a separate and complete system, but though many attempts were made this could not be made available with the existing lines owing to the extraordinary growth of traffic in the interval. The construction of a completely new telephone line between Frankfort-on-Main and Zurich had to be faced, and this line has already been completed as far as the Swiss frontier. Meanwhile, the re-opening of direct communication between Berlin and Milan has had to be postponed.

* * *

The German government hopes to raise 1,000,000,000 marks by unusual levy on telephone subscribers.

* * *

NEW ZEALAND

The telephone service is about a year in arrears in New Zealand. There are some 7,000 subscribers waiting to be connected with the various exchanges in the Dominion, and the new rates have had no effect on the continued steady increase of applications. During 1919 ever 6,000 new subscribers were connected up, this being a record. Materials are now coming to hand slowly. In different parts of the Dominion the department is faced with the construction of 1,456 miles of pole line and 10,068 miles of open aerial telephone wire, and many miles of telephone cable, carrying anything from 25 to 600 pairs of wires in each cable. In addition to this, 565 miles of main lines are badly in need of overhaul. At Auckland the situation is more acute than in any other part of New Zealand, and special steps have been taken to expedite the installation of temporary automatic switchboard equipment at the central exchange and in the different suburbs, in order to cope with the difficulty.

* * *

SOUTH AFRICA

The number of connections to the Johannesburg telephone exchange has grown in thirteen years from 2,900 and one exchange to 13,130 connections and four exchanges. Plans for further development contemplate 20,000 telephones in the municipal area by the end of another ten years. There is now one telephone to every eleven white inhabitants, as against one to twenty-five in London and one to nine in the United States.

* * *

AUSTRALIA

A sum of £380,460 is to be expended in 1921 on the improvement of the telephone and telegraph services in New South Wales, allotted as follows: Telegraphs, £9,460; telephones, £117,000; new trunk lines, £30,000; switchboards, £39,000; cable and conduits, £183,000; and miscellaneous, £2,000. In addition, tenders for further materials are to be accepted and paid for this year, and other tenders are to be invited and paid for in 1921-22 up to a total of £500,000. This year £43,000 has already been expended by commitments; the estimated cost of providing additional switchboards at the new automatic exchange in Sydney is £81,784, and £3,750 has been provided for increasing the country service, which will enable fifteen lines to be erected; twenty-five others have been approved, and material is to be obtained. All essential materials can be procured if funds are provided, but deliveries are subject to delay.

* * *

The use of wireless telephony for communication with remote districts in Australia is being experimented with by the Postal Department. If the experiments justify it, the Postmaster General hopes in the near future to establish a wireless telephone service for residents in remote places where land line communication would be prohibitively costly. He points out, however, that the use of wireless telegraphy, which is developed to a greater degree than wireless telephony, for commercial purposes, offers more satisfactory conditions as regards skilled attendance, cost, and facility of operation, and he has already approved of licenses being granted for the erection of such stations in the northern territory and remote parts of Queensland and South Australia. They will be in communication with existing Commonwealth radio stations.

* * *

SWEDEN

The increased telephone fees recently imposed have aroused indignation all over the country. According to the Financier, before the State Telegraph Department bought the Allmanna Telefonbolaget, its only competitor, it tried to keep the fees low, but no sooner had it bought the company than its policy was changed.

* * *

ENGLAND

Mr. Godfrey Isaacs, managing director of the Marconi Co., has sailed for the United States, where he hopes to complete plans for the creation of a trans-Atlantic wireless telephone service between New York and London, Paris, and other European centers. He is said to believe that such communication can be established at a cost only slightly

* * *

Britain has conferred imperial honors upon stenographers and telephone operators for performing distinguished service during the war.

* * *

SPAIN

Government supervision of the telephone system has been decided upon owing to the incessant complaints of bad service given by the company now possessing the monopoly. In the event of the complaints being justified, the government will revise the concession, and possibly take over the whole system.

The Computation of Quantities of Telephone Switching Equipment*

By FRED L. BAER
Sales Engineer Automatic Electric Company.

KNOWLEDGE of the amount of traffic in a telephone exchange and its distribution with respect to 5,000 lines and additions have been time and destination, is essential, to be able to provide central office equipment which is adequate for the subscriber's needs.

In the planning of an exchange it is important that the network be so designed as to accommodate the anticipated traffic demands on an economic basis, since in no other industry is there found such a heavy plant investment for the relatively short period of its useful service. From the standpoint of the subscriber, telephone service does not measure up to its fullest efficiency unless facilities are available for completing his connection whenever desired. On the other hand, to provide the necessary equipment to take care of all emergencies and traffic demands not anticipated, would require an investment that would entail such high charges for service as to defeat its own purpose. For good commercial telephone service, therefore, we are chiefly interested in knowing how much switching equipment to provide so that not more than a certain number of calls, say an average of 1 to 100, or 1 to 1,000, will be lost.

For computing the number of trunks required to carry efficiently a given amount of traffic, various formulas are in use, some determined empirically, and others based on the laws of probability, although it seems needless to establish with extreme accuracy what particular formula or set of curves to use in computing quantities of equipment, when we consider the much greater error possible in the compilation of the traffic date, and in the assumptions of future growth and distribution of traffic.

A review of various articles published in recent years brings out the following facts:

First—That a fairly fixed relation exists between the number of busy hour calls of given duration, and the maximum number of simultaneous calls during the busy hour.

Second—That within the limits of holding times as ordinarily encountered in telephone practice, the preceding relation holds true regardless of the number of busy hour calls and the average holding time, so long as the product of these two factors remains constant.

Third—That the average calling rate of a large group of subscribers usually differs somewhat from the average calling rate of a small part of that group.

While all of the methods described in the various articles are very interesting, since the ultimate results as shown in the chart (Fig. 1) do not differ materially, it will not be necessary here to go into details regarding the derivation of the curves, but use will be made of the results only.

Let A equal average number of calls during period (call hours T C).

C equal average calls during the busy hour.

T equals average holding time in hours.

X equals number of trunks.

P equals probability.

Campbell's empirical formula $X = TC \div 2.8\sqrt[3]{TC}$, later changed to $X = TC + 3.7\sqrt[3]{(TC)}$ was derived from observations of calls handled by groups of 40 or less trunks. If $X = 10$, the traffic indicated by this formula would be carried with a probability of loss of 1 call in 100. In the practical application of this formula to larger groups, certain percentages have been added that have not been taken into account by the various commentators. In curve E this formula is blotted without the percentage factor.

The probability that in a certain interval there will be various numbers of simultaneous calls may be represented as in Illustration 1.

The probability that in certain intervals there will be X calls in progress in a group limited to X outlets, is expressed by Illustration 2.

This latter expression more nearly represents a theoretical measure of the lost calls, while the expression for Px above is a very accurate approximation and lends itself to ready calculation. This is shown as curves C and D in Fig. 1.

The results for the expression Px + are in more general use, and while perhaps not theoretically representing a measure of the lost calls, in providing slightly more equipment for a given amount of traffic, the error is on the safe side. This is shown in curves A and B, Fig. 1 and tabulated in Table A.

$$0 \text{ calls} = p_o = \frac{1}{(1+a+\frac{a^2}{2!}+\frac{a^3}{3!}+ \text{ - - - - - - - - - } \infty)} = e^{-a}$$

$$1 \text{ call} = p_1 = \frac{a}{(1+a+\frac{a^2}{2!}+\frac{a^3}{3!}+ \text{ - - - - - - - - - } \infty)} = ae^{-a}$$

$$2 \text{ calls} = p_2 = \frac{\frac{a^2}{2!}}{(1+a+\frac{a^2}{2!}+\frac{a^3}{3!}+ \text{ - - - - - - - - - } \infty)} = \frac{a^2e^{-a}}{2!}$$

$$x \text{ calls} = p_x = \frac{\frac{a^x}{X!}}{(1+a+\frac{a^2}{2!}+\frac{a^3}{3!}+ \text{ - - - - - - - - - } \infty)} = \frac{a^xe^{-a}}{X!}$$

$$x \text{ or more calls} = p_{x+} = e^{-a}\left(\frac{a^x}{x!} \times \frac{a^{x+1}}{(x+1)!} \times \frac{a^{x+2}}{(x+2)!} \text{ - - - - -}\right)$$

$$\text{More than x calls} = p_{(x+1)+} = e^{-a}\left(\frac{a^{x+1}}{(x+1)!} \times \frac{a^{x+2}}{(x+2)!} \text{ - - - -}\right)$$

Illustration No. 1.

$$p_{1x} = \frac{\frac{a^x}{X!}}{(1 \times a \times \frac{a^2}{2!} \times \frac{a^3}{3!} \text{ - - - - - - - - - - - - } \frac{a^x}{x!})}$$

Illustration No. 2.

* Paper presented before Western Society of Engineers.

Trunks	P = .001 TC	P = .01 TC
1	.0010	.010
2	.0454	.149
3	.191	.436
4	.429	.823
5	.739	1.28
6	1.11	1.79
7	1.52	2.33
8	1.97	2.91
9	2.45	3.51
10	2.96	4.13
12	4.04	5.43
14	5.20	6.78
16	6.41	8.18
18	7.66	9.62
20	8.96	11.1
30	15.9	18.7
40	23.3	26.8
60	38.9	43.5
80	55.2	60.7
100	71.9	78.2
140	106.3	114.0
180	141.4	150.3
200	159.	169
300	249	261
400	341	355
500	434	450
600	527	545
700	621	640
800	715	736
900	810	832
1000	905	928

Table A. Busy-Hour Average Calls and Trunks to Care for Them.

For the purpose of this paper the values of curves A and B shown on the chart and in Table A will be used. These values have been taken from the table appearing in an article by Mr. Molina, of the American Telephone and Telegraph Company, published in the American Mathematical Monthly of June, 1913.

FRED L. BAER.
Sales Engineer Automatic Electric Company.

The first requisites for determining the quantities of equipment for an automatic office in an exchange area, are to know the number of lines affected, the various classes of service given, the number of calls per busy hour and the holding time or average duration of calls within the office as well as calls to other offices. It is also essential to know what provision is to be made for growth during the initial period as well as the provision for the ultimate.

It is generally recognized that, when an automatic system replaces a manual system the average calling rates per station or per line are increased and that the average holding times are decreased. It is also known that the decrease in holding time is greater than the saving in operating time; in other words, the average duration of conversation decreases. It is also known that the decrease in holding time is greater than the saving in operating time; in other words, the average duration of conversation decreases. It is reasonable to assume that in any community, the amount of conversation carried during a given period would be practically the same whether carried by an automatic or a manual system. It can, therefore, be considered that the product of the number of calls and the average conversation time for a given period remains constant, regardless of how the traffic is handled. But if we assume that the product of calls and holding time are the same under manual and automatic conditions, that is, if we do not deduct the saving in operating time, then there would be a margin for probable increased amount of conversation incident to the use of the automatic system. It is, of course, not reasonable to use the calling rate as estimated for a manual system and the holding time as estimated for an automatic system, since the resulting product will represent traffic somewhat lighter than that which is likely to be experienced.

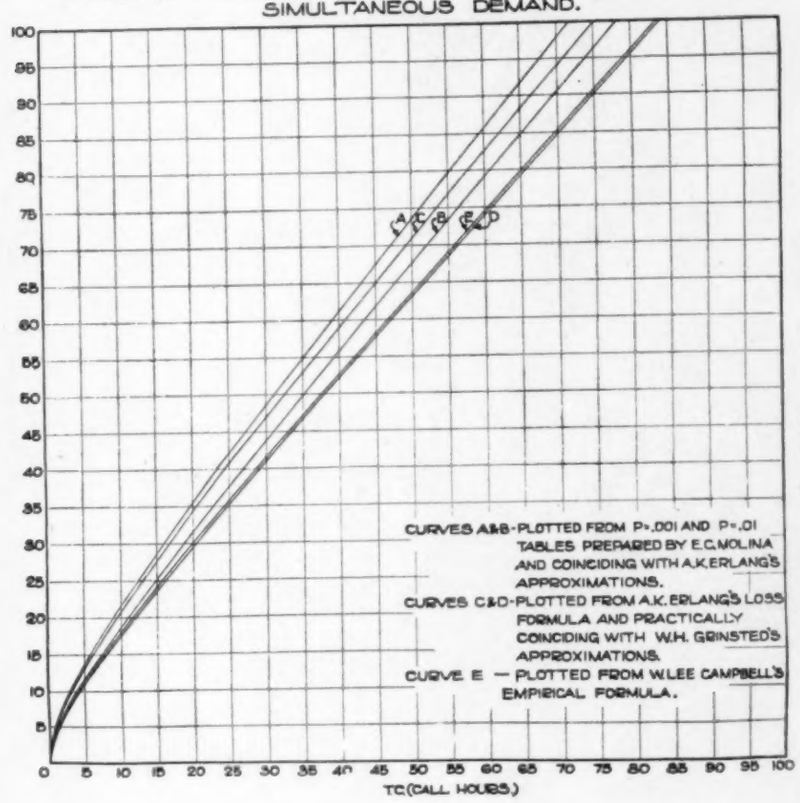
In compiling data for use in determining quantities of automatic equipment, the calls and holding times, if based on manual experience, should be projected to the initial period and should be based on observations made during the busy season of the year.

Arrangement of Multiple:

If a trunk searching element is limited to ten outlets, the amount of traffic handled is independent of the order of selection, assuming the selection to be instantaneous as is practically the case. That is, if ten outlets are available say, to 100 selectors, it is immaterial whether the outlets are tested in regular rotation beginning with the first one each time, or whether they are arranged so that the first ten selectors will begin by testing the first outlet, the second ten by first testing the second outlet and finishing with the first, the third by first testing the third outlet and finishing

FIGURE 1.

CURVES SHOWING RELATION BETWEEN BUSY HOUR AVERAGE CALLS AND NUMBER OF TRUNKS TO CARE FOR SIMULTANEOUS DEMAND.


A B C D
CURVES A&B-PLOTTED FROM P=.001 AND P=.01 TABLES PREPARED BY E.C.MOLINA AND COINCIDING WITH A.K.ERLANG'S APPROXIMATIONS.
CURVES C&D-PLOTTED FROM A.K.ERLANG'S LOSS FORMULA AND PRACTICALLY COINCIDING WITH W.H. GRINSTED'S APPROXIMATIONS.
CURVE E — PLOTTED FROM W.LEE CAMPBELL'S EMPIRICAL FORMULA.
TC(CALL HOURS.)

with the second, etc. The first arrangement, however, would not be used because of the excessive wear on the switch connected to the first trunk and the excessive amount of rotation on each of the hundred first selectors, since if the traffic indicated an average of 4.13 simultaneous calls, it would mean that half the calls would be extended to the first four trunks, and for the remaining half the switches would rotate over at least four contacts, to find one of the six remaining trunks.

Table B shows the amount of traffic handled per trunk in a group of ten when the trunks are selected in regular rotation beginning from the first. These figures were derived from the 1 in 100 column of Table A.

Order of Selection	Traffic per Trunk	Summation of Traffic
1.....	.62	.62
2.....	.60	1.22
3.....	.58	1 80
4.....	.54	2.34
5.....	.51	2.85
6.....	.457	3.307
7.....	.387	3.694
8.....	.287	3.981
9.....	.139	4.120
10.....	.01	4.13

Table B. Traffic Handled per Trunk in Group of Ten.

From the foregoing table we can determine the probable traffic carrying capacity of a group of trunks with various methods of bank multiplying. Consider case 1, Fig. 2, where the first five trunks in each group would handle 2.85 T C and the common group would handle 1.28 T C, or a total of 6.98 T C. This is capacity greater than that of either a group of ten and a group of five, or 1.5 groups of ten, but not so great as that of a group of fifteen. Advantage is not taken of this increased capacity in the direct computation, which in this case would be 1.5 groups of ten, but the arrangement is used to provide an additional margin of about 12½ percent to care for unforeseen variations.

In case 2, having three individual groups of five, and a common group of five, the twenty trunks would carry 9.83 T C or about 20 percent more than two groups of ten. In case 3, the thirty trunks would handle 14.725 T C or about 19 percent more than three groups of ten. In case 4, in a similar manner it may be computed that the twenty trunks would handle 9.83 T C or about 20 percent more traffic than two groups of ten.

In the following notes it is proposed to show how the traffic data are used to compute the quantities and distribution of the various elements of switching equipment in a Strowger automatic exchange.

Primary Line Switches:

Since there is a line switch associated with each subscriber's line the number of working primary line switches is determined from the number of working lines.

When a subscriber's intermediate distributing frame is interposed between the line switches and the connector banks; so that any line switch can be cross connected to any terminal number, it is necessary, due to circuit requirements, to group the primary line switches in classes for the following services: Flat rate, message rate, and paystation rate. On the other hand, if an intermediate frame is not used and the line switches are permanently connected to the terminal numbers, then the flat rate group must be further subdivided into individual lines, party line and P. B. X. groups, and the message rate group must also be subdivided into individual line and P. B. X. groups.

In either case in grouping the line switches for the various classes of service, precautions should be taken so that the paystation lines and message rate lines do not have access to the same first selector switches; otherwise, under certain conditions, there would be premature registration of meters on message rate lines, due to the circuit requirements of pre-payment paystation service.

The number of primary line switches provided for the initial period for each class of service is usually 5 percent greater than the number of working lines and the number of terminals (con-

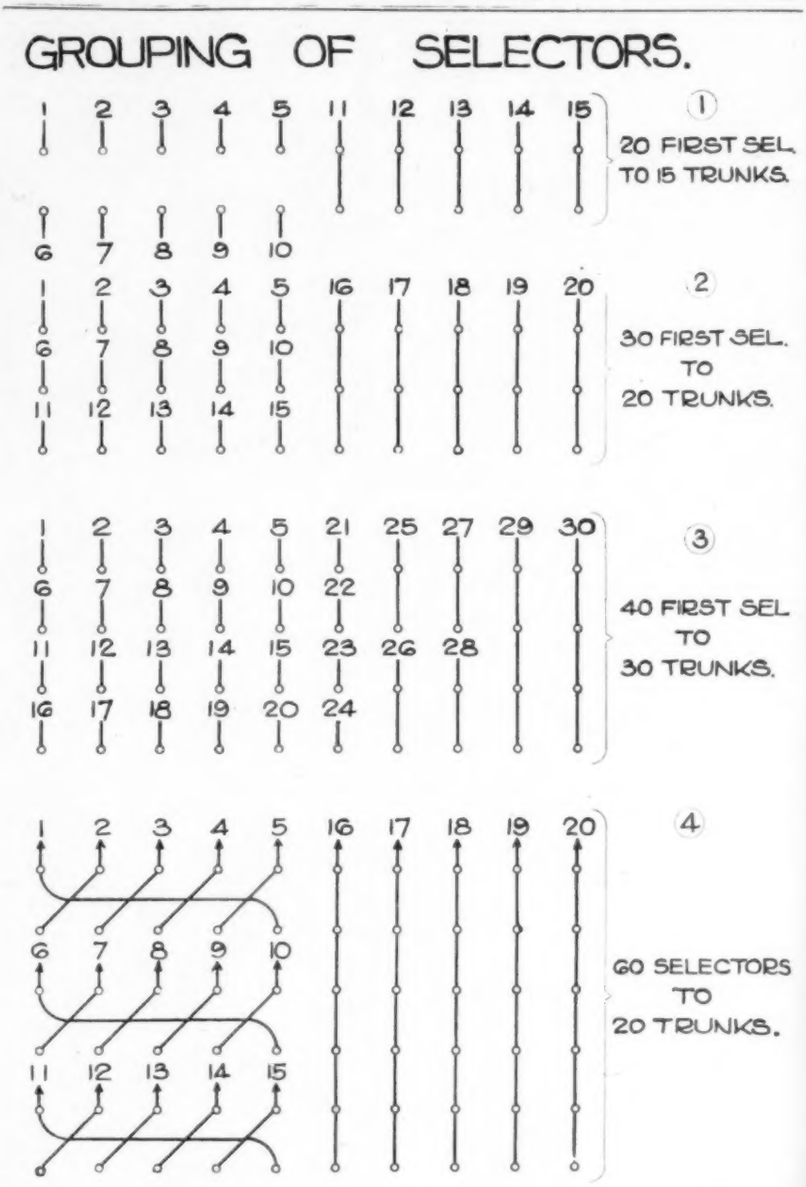


FIGURE-2

nector numbers) is usually 10 percent greater than the number of working lines.

Grouping of Primary Line Switches:

It is recognized that when the average calling rate per line for a certain class of service is based on the originating traffic on a thousand or more lines, the calling rate for any small groups, such 25, 50, 75 or 100 lines, will vary from this average rate. However, if the average calling rate is based on a smaller number of lines, there will be little or no variation when considering small groups. Table C shows the percentage variation that can be allowed for the various small groups at different calling rates:

Size	Less	.8	1.3	More
25	70	60	50	40
50	50	44	37	30
75	40	35	30	25
100	35	30	25	20
Group.	than .8.	to 1.3.	to 2.	than 2.

Table C. Average Calling Rate per Line.

Assuming that the number of line switches is 5 percent greater than the number of working lines, Table D indicates the proper grouping of plunger type line switches per master switch, for various calling rates and with a holding time of 120 seconds.

Prim. Lineswitch per Group.	100		75		50		25			
Calling rate per working line	.85	1.	1.1	1.28	1.61	1.89	2.1	2.63	3.16	3 72
Calling rate per equipped line.....	.81	.957	1.04	1.22	1.53	1.8	2.	2.5	3.	3.54
Trunks per group...	9	10	9.	10	9.	10.	7.	8	9.	10

Taple D. Proper Grouping for Various Calling Rates.

Ordinarily the average traffic would not be so great as to necessitate groups of less than fifty lines per master switch, except in unusual cases, such as where P. B. X. trunks or other busy flat rate lines are grouped together. In this case the lines of heavy traffic can be isolated and grouped 25 per master switch, thus reducing the average calling rate of the remaining lines.

First Selectors (Without Secondary Line Switches):

If local secondary line switches are not used, the number of first selectors would correspond to the number of equipped outlets from the primary line switches as explained in the previous paragraphs.

First Selectors (with Secondary Line Switches):

When each of the ten trunks from each primary sub-group leads to a secondary line switch, which in turn has ten outlets to first selectors, then each primary line switch will have access to 100 first selectors, and these 100 first selectors function as one group. As explained in the following section, a group of 100 outlets reached through secondaries is not fully as efficient as if reached direct. The 100 first selectors may, however, be considered as having the effectiveness of a group of 85. If we consider that first selectors are sometimes held busy by line "shorts" or "grounds" 'or by subscribers unwittingly leaving their receivers down, it becomes necessary to allow for some margin, and this margin is obtained by using the 1 in 1000 probability.

From Table A it can be determined that a group of 85 trunks will handle 59.4 T C (call hours) with a probability of loss of 1 in 1000. Therefore, 100 first selectors reached through secondaries can be considered to carry safely 59.4 T C, and under certain conditions it has been considered that satisfactory service could be given on the basis of 100 first selectors carrying 75 T. C. On the basis of 100 first selectors carrying 59.4 T. C, the efficiency of the switches would be 59.4 percent and the average occupancy per switch would be .594.

Local Secondary Line Switches:

Each of the ten trunks controlled by any primary master switch leads to a secondary line switch in a different secondary sub-group, each of which, in turn, has its own ten outlets to first selectors. By reference to Fig. 3, it may be seen that any primary line switch may at different times take any one of 100 first selectors. Since it is usually necessary to group from 18 to 25 primary sub-groups to ten secondary sub-groups, and since from any one primary sub-group there is only one outlet to each secondary sub-group, it is evident that if the ten outlets from any secondary sub-group have been made busy by calls from ten primary sub-groups, the remaining primary sub-groups must be deprived of access to this secondary sub-group. Each of the remaining primary sub-groups will then only have nine available outlets. The general effect of this is somewhat to reduce the availability of the 100 first selectors. Experience has shown that good service can be given on the assumption that not more than 85 switches are ever in use simultaneously.

In order to minimize the difficulty of unavailable trunks from primary switches it is necessary to distribute the traffic evenly among the secondary sub-groups, and the following three methods are practiced to contribute towards this end:

First—A special scheme of cross connection between primaries and secondaries so that whenever there is a tendency for the primaries to build up before a certain sub-group the next call attempted will break up the combination.

Second—The "step-off" relay on each secondary sub-group is so arranged that when this secondary sub-group has a predetermined number of calls in progress on successive trunks, all of the primary switches which had pre-selected trunks to this secondary section are stepped off to another sub-group.

Third—When a secondary sub-group has all trunks busy, all of the primary master switches associated with that entire secondary group are caused to operate momentarily. This aligns all of the disengaged primary line switches on the shaft, and re-groups the primary preselections.

If, from each primary sub-group, only eight outlets are equipped, even though ten secondary sub-groups are used to carry the traffic to 100 first selectors, there would not be a theoretic group of 100, but rather one and one-fourth times a theoretic group of 80. However, there is so little difference between the two that a theoretic group of 100 can be considered as correct.

To compute the number of secondary line switches to a group of ten subgroups, we must first determine the number of primary sub-groups required to load the group. Consider that 100 first selectors reached through secondaries will handle 59.4 T C. The number of primary sub-groups to be placed in one group may be computed by dividing this by the average traffic offered per primary sub-group represented by n T C (n being the number of working lines in the primary sub-group, C being the number of calls per line, and T being the holding time in hours). If the result is a mixed number, then only as many primary sub-groups should be grouped together as are represented by the whole number, unless it is known that there are margins in the original data, which would permit using the next larger whole number. After this has been determined the average occupancy of the first selectors should be determined on the basis of actual traffic handled, which will usually be somewhere near 59.4 T C.

Rotary Secondary Line Switches:

If rotary type secondaries are used, each group is made up of ten sub-groups having 25 outlets, providing a theoretic group of 250 outlets, or an effective group of $.85 \times 250$, or 212.5. If a theo-

retic group of 250 is too large, by using less than 25 outlets, various smaller theoretic groups, such as 240, 220 or 220, may be obtained.

The number of primary sub-groups required to furnish traffic for a secondary group is determined much as in the case of plunger type secondaries. A theoretic group of 250 trunks or an effective group of 212.5 will handle 174 T C (call hours), hence from 50 to 60 primary sub-groups will be required to keep a group of rotary secondaries busy. Present practice in mounting the secondary line switches prohibits the placing of more than 50 primary sub-groups to a group.

Second Selectors:

From the traffic data we can obtain the percentage distribution of the originating calls, and thus determine the calls that are to be handled by second selectors.

A group of ten trunks will handle 4.13 T C with a probability of loss of 1 in 100. Dividing the total number of call hours to be handled by 4.13 will give the number of groups of ten of second selectors.

When the first selectors are reached through secondary line switches, the resulting increase in efficiency is felt beyond the first selectors. In other words, ten second selectors should carry more traffic than 4.13 T C.

Suppose, in an office that had just sufficient traffic for 200 first selectors (T C -2×59.4), that 70 percent of the total traffic (83.16 T C) was local. Dividing this by 4.13 would indicate a need for slightly more than 200 second selectors. Obviously, such a number of selectors is too high, since it would be more than the number of first selectors. Accordingly, some allowance can be made for the greater efficiency of second selectors when a relatively large percentage of the traffic is local.

It is also necessary to determine the method of multiplying the first selector banks, because sometimes the number of second selectors must be adapted to the method of multiplying. The preferred method is to determine the number of second selectors working in groups of ten, and then arrange the first selectors so that each group will have a number of second selector trunks individual, and the remainder common to two or more groups. For instance, 15 trunks from 20 first selectors may be so arranged that there will be five trunks individual to each group of 10 selectors and 5 trunks common to the entire 20. If the arrangement is such that the individual trunks are tested first, the entire group will handle 6.98 T C with a probability of loss of 1 in 100.

The other method is to determine the occupancy of the first selectors for the particular level under consideration, and group together a sufficient number of first selectors on the basis of this occupancy, to offer 4.13 T C to the second selectors. If the resultant number of first selectors is not a multiple of five, the number of first selectors is cut down and sufficient trunks are equipped to handle the traffic from such reduced group of first selectors.

Trunks to Other Offices:

If the trunks are taken directly from selector levels, the number of trunks is determined in practically the same manner as the number of second selectors just described. Since the trunks operate through cable pairs to other offices, it is advisable to provide some margin to allow for trunks that may be unavailable because of cable conductors being in trouble. This margin is usually provided by using 1 in 1000 probability instead of 1 in 100, or, in other cases, by using the 1 in 100 table and adding a certain percentage to the resultant number of trunks.

If outgoing secondary line switches are used, the number of trunks in the group is determined from the 1 in 1000 probability table, on the basis of the theoretic group being only 85 percent available as explained for first selectors. Either plunger type or rotary type line switches may be used for outgoing secondaries.

The number of trunks thus determined gives also the number of impulse repeaters required at the originating office, and the number of incoming second selectors in the distance office.

Outgoing Secondary Line Switches:

After the number of outgoing trunks has been determined, as just outlined, then the number of secondary sub-groups can be determined on the basis of a certain number of trunks per sub-group. If the number of sub-groups is less than ten, each ten-trunk group must be divided as evenly as possible among all secondary sub-groups, so that there will be more than one outlet for each trunk group, leading to each secondary sub-group. This results in somewhat lowered efficiency, since if a certain secondary sub-group is momentarily or permanently busy, two or more outlets would be busy to the first selectors. In such cases the ten trunks are considered at only 85 percent of their theoretic efficiency, and will handle $.85\times 4.13$, or 3.51 T C.

The number of outgoing secondary line switches can be determined on the basis of ten outlets handling 4.13 T C or 3.51 T C, as the case may be, and then grouping the first selectors so that each group has a certain number of trunks individual to the group, and the remaining trunks common to two or more groups; or, as in the case of determining the number of second selectors, the occupancy of the first selectors for the particular level under consideration is determined and the first selectors arranged in groups so as to offer 4.13 T C or 3.51 T C per group. If the resultant number of first selectors is not a multiple of five, the number of first selectors is cut down and a sufficient number of outlets are equipped to care for the traffic offered by the reduced number of first selectors.

Third Selectors:

The third selectors in a five digit system are used for distributing the calls to the various hundred groups in each thousand. Third selectors working in groups of ten can handle 4.13 T C. Accordingly, the number of groups of ten required for each thousand may be computed by dividing the total amount of traffic to be handled by each level by 4.13 T C. The second selector banks should then be so multiplied as to keep these groups of ten uniformly busy.

In case the scheme of multiplying which is used is such that the local traffic is kept separate from the incoming traffic, because of the fact that the incoming switches may be reached through outgoing secondaries at the originating office, they will handle traffic at different rates. Therefore the occupancy per second selector for each level will have to be determined for both incoming and local switches, and the proper number of switches combined to supply ten trunks. The resultant grouping of second selectors should be in multiples of ten.

Connectors:

The number of connectors is computed by first determining the average calls terminating in each hundred and applying a percentage for variation as shown in Table C. Then, if the traffic is less than ten trunks will carry we determine from the equivalent T C value the number of connectors from the second column of Table A. If the number of calls is greater than ten trunks will carry, then by dividing the number of calls by the number that ten trunks will carry, the necessary number of groups of ten may be found. The third selector multiple may then be arranged so there will be individual and common trunks. If this is not done, the number of connectors must be determined on the basis of full groups of ten and a remaining partial group.

To take care of toll calls from toll selector banks, combination toll and regular collectors can be provided. These should be arranged so that they are the last choice for regular calls, so

as to secure maximum availability for toll calls.

Rotary Connectors:

The method of determining the number of these connectors is the same as for regular connectors. Due to the fact that the calling rate to P.B.X. rotary groups is much heavier than to regular groups, and that the calling rate given is usually the result of observation of this particular class of calls, it is not necessary to add much, if any, percentage for variation.

Combination rotary connectors are, as a rule, rather complicated and there is therefore little economy in providing them. Accordingly, separate toll rotary connectors are provided and their number is computed in a similar manner as for local connectors.

Application:

It is believed that the principles just described will be better understood and made more interesting by a practical application. For this purpose we may consider a four office network, and compute the amount of equipment needed in one of the offices to care for the assumed traffic.

Assume that the office under consideration has 6000 working lines originating 10,692 B.H.C. (busy hour calls) of 120 seconds average duration, and assume further that this office is equipped with 6300 line equipment and 7000 connector terminals. The distribution of traffic may be assumed as follows:

	Local Outgoing	Incoming
A.....	4277	.....
B.....	 2299	2580
C.....	 3546	3292
D.....	 570	590

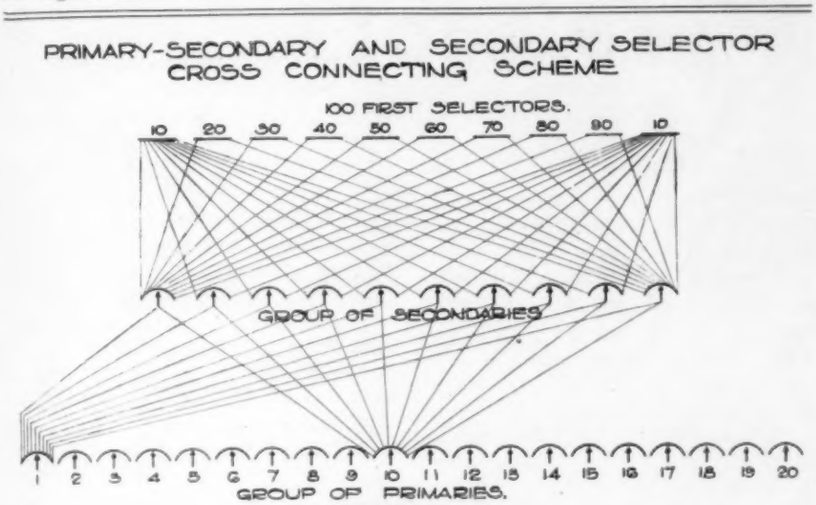
The assumptions for the traffic distribution to the thousands and hundreds groups are shown in Fig. 4.

On the basis of these assumptions the quantities of equipment may be computed by either of the two methods described.

FIRST METHOD.

Primary Line Switches:

Allowing 5 percent of the number of primary line switches in excess of the number of working lines, to care for regrouping of lines and to equalize traffic, the 6000 working lines would require 6300 line switches originating a total of 10,692 B.H.C. of average duration, 120 seconds.


PRIMARY-SECONDARY AND SECONDARY SELECTOR CROSS CONNECTING SCHEME
100 FIRST SELECTORS.
10 20 30 40 50 60 70 80 90 10
GROUP OF SECONDARIES
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
GROUP OF PRIMARIES.
FIGURE-3

The average calling rate per equipped line would be about 1.7 B.H.C. From Table D, which happens to have been worked out for calls at the 120-second holding time, we see that for a calling rate between 1.53 and 1.8 per line equipped the line switches should be grouped 50 per master switch. The 50 line switches will offer 85 B.H.C. Allowing for group variation of 37 percent as indicated in Table C, we can expect that at time the group will offer traffic at the rate of 115 B.H.C. We find from Table A that ten trunks will handle 4.13 T C or 124 B.H.C. at 120 seconds duration, with a probability of loss of 1 in 100. Therefore the 6300 line switches should be provided in 126 sub-groups of 50.

First Selectors:

If the first selectors are reached through secondary line switches, each hundred first selectors will, as we have already seen, handle 59.4 T C, or 1782 B.H.C. at 120 seconds duration. To handle 10,692 B.H.C. will, therefore, require six groups of 100 switches each, or 600 first selectors. It will be seen that the traffic assumed would require a certain number of full groups. If, however, there were a partial group left over, then a smaller group, say, of 50 or 60, or as may be required, would be provided.

Local Secondary Line Switches:

As previously explained each hundred first selectors is fed by a group of secondaries consisting of 10 sub-groups. Since we have six major groups of secondaries, there will also be six major groups of primaries, each group consisting of 21 sub-groups of 50 switches each. Since each sub-group of primaries has 10 outlets to secondary switches, there would be 210 secondary line switches in each secondary group; and since each secondary group has 10 sections, there would be 21 secondary

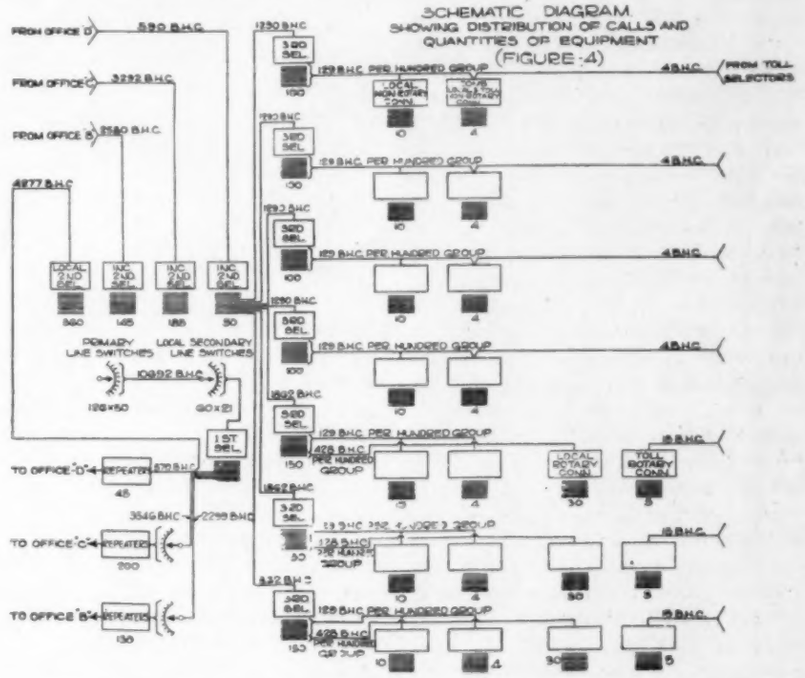


FIGURE-4

line switches per sub-group. From this we may see that there would be a total of $6 \times 10 \times 21 = 1260$ secondary line switches and $6 \times 10 = 60$ secondary master switches.

Local Second Selectors:

From Fig. 4 we see that the local traffic consists of 4277 B.H.C. Since 10 outlets will handle 4.13 T C, or 124 B.H.C. of 120 seconds duration, to handle the local traffic would require 34½ groups of 10, or 345 local second selectors; a trial grouping showing that 360 local second selectors should be provided. Using the multiplying scheme as shown in Fig. 2 for the second level of first selectors, we see that for each 10 first selectors, the first five contacts have access to five individual trunks, and the last five contacts have access to five trunks shared with 50 other switches. This grouping would provide 60 groups of five individual trunks and 12 groups of five common trunks, or a total of 360. It should be noted from Table B that the carrying capacity of the 60 groups of individual trunks is 60×2.85, of 171 T C, and that of the 12 groups of common trunks of 12×1.28, or 15.36, or a total of 186.36 T C, which represents 5590 B.H.C. of 120 seconds duration. This arrangement of multiplying provides in this case for an increase of approximately 30 percent above the normal local traffic.

Outgoing Trunks to Office "B":

The 2299 B.H.C. representing the outgoing traffic to Office B is equivalent to 76.6 T C at 120 seconds duration. Since 100 trunks will handle 59.4 T C, 1.28 groups of 100, or 130 trunks, will be needed to handle this traffic. It will be noted that this was computed on the basis of a probability of loss of 1 in 1000. We might have made the computation on the basis of loss of 1 in 100, which would have indicated a need for 118 trunks. Adding 10 percent to this result to allow for trunks being unavailable due to conductor trouble, would give the same result as before, namely, 130 trunks. The number of trunks incoming at Office B from Office A will also be 130.

Since the outlets from the first selectors to the outgoing secondary line switches will be in groups of 10, and since 10 trunks will handle 124 B H.C. of 120 seconds duration, we would therefore need 18.5 groups of 10, or 185 outgoing secondaries. To facilitate grouping and to provide additional margin, we could profitably install 200. The 600 first selectors could be grouped on the basis of 30 first selectors to 10 outgoing secondaries; or, if desired, we could arrange 60 first selectors to 20 outgoing secondaries, by means of 3 individual groups of 5 and 1 common group of 5. The latter arrangement would provide a margin of nearly 30 percent to care for emergencies.

Outgoing Trunks to Office "C":

The 3546 B.H.C. of 120 seconds duration, representing the outgoing traffic to Office "C," is equivalent to 118.15 T C. This would require 1.99 groups of 100, or, say, 200 trunks.

The number of outlets from the first selectors to the outgoing secondary line switches = 3546/124, or 28.6 groups of 10 outgoing secondaries. It would probably be more convenient to provide 300. These would be arranged on the basis of 6 individual groups of 4 and one common group of 6 for each 60 selectors, providing about 16 percent margin.

Outgoing Trunks to Office "D":

The 570 B.H.C. representing the outgoing traffic to Office "D" would be carried direct to outgoing trunks, and not through secondaries. The number of trunks must, therefore, be computed as working in groups of ten, giving 570/124, or 4.5 groups, or 45 trunks. These could be arranged in 6 individual groups of 5 and 3 common groups of 5, or total of 45 trunks. This arrangement would provide a margin of nearly 10 percent for emergencies.

Incoming Second Selectors from Office "B":

Assuming that the outgoing trunks at Office "B" are reached through secondaries, the 2580 B.H.C. would indicate a need of 145 trunks computed as above.

Incoming Second Selectors from Office "C":

Assuming that the outgoing trunks at Office "C" are reached through secondaries, a need of 185 trunks would be indicated.

Incoming Second Selectors from Office "D":

The 590 B.H.C. originated by Office "D" would be carried direct to outgoing trunks. Working in groups of ten, 50 trunks would be needed.

Third Selectors:

For each of the 1, 2 and 3 thousand groups, it is assumed there will be 1862 B.H.C. This means that from the local and incoming second selectors to third selectors, we would need 1862/124 = 15 groups of ten, or 150 trunks for each of the first three levels. The detail arrangement of the multiple is too tedious to describe here; suffice it to say that consideration is given to the fact that the local and incoming selectors are handling calls at different rates on account of some being fed through secondaries.

For each of the 4, 5, 6 and 7 thousand groups it is assumed there will be 1290 B.H.C. Each of these four levels must therefore provide 1290/124 = 10 groups of ten, or 100 trunks to third selectors.

Connectors:

For each of the regular hundreds it is assumed that there will be 129 B.H.C. of 120 seconds duration and 4 toll calls of 240 seconds duration. The total traffic would then be

$$4.3 \text{ T C} + .266 \text{ T C} = 4.566 \text{ T C.}$$

Allowing for a group variation of 25 percent as shown in Table C, we must provide facilities for handling 5.7 T C. We should therefore need 1.38 groups of ten, or 14 connectors, four of which could be combination connectors and the remainder regular connectors. The combination connectors are used for incoming toll calls and are last choice for regular calls. Five individual trunks would be taken off the first contact, one trunk from each of five divisions of third selectors; five trunks would be taken off the next five contacts, which would be multiplied through all switches, and four trunks would be taken off the last four contacts in such a manner that the trunks from these contacts would seldom be used and would be almost continuously available for toll. This arrangement of trunks will provide for nearly 15 percent increase over the variation allowed above.

Rotary Connectors:

For each of the P.B.X. hundreds it is assumed that there will be 428 B.H.C. of 120 seconds duration. This is equivalent to 14.3 T C and would require 34 connectors. Since this calling rate is very heavy and is established from traffic for a comparatively small group of lines, no group variation need be allowed. By arranging five individual groups of 5, and a common group of 5, or a total of 30 connectors, we could handle 15.53 T C, which would be nearly 9 percent above the average traffic.

Assuming that there are 15 B.H.C. of 240 seconds duration from toll, and allowing for a 25 percent variation, the traffic would be represented by 1.25 T C, requiring 5 toll rotary connectors.

SECOND METHOD.

In computing the number of primary line switches, local secondary line switches and first selectors, there may be slight differences in detail, but the final result is nearly the same, whatever method is practiced.

Local Second Selectors:

The average occupancy per first selector with respect to all calls is $\frac{59.4}{100} = .594$.

The average occupancy with respect to the second level for local calls is

$$4277/10692 \times .594 = .238.$$

Since 10 outlets will handle 4.13 T C, the number of first selectors required to feed 10 trunks would be 4.13/.238, or

approximately 18. Since this is not a multiple of 5, and since it is reasonable to suppose that 20 first selectors would overload the group, it is necessary to drop back, say, to 15 selectors. This number, we find, would offer 3.57 T C, which could be handled by 9 trunks. We would therefore provide 600/15, or 40 groups of 9; a total of 360 local second selectors. These would be wired with banks and shelves for 40 groups of 10. If, however, it was unlikely that the tenth trunk would ever be utilized, the multiplying scheme outlined in the first method would be preferable.

Outgoing Trunks to Office "B":

The number of outgoing trunks would not differ in applying the second method, but the number of associated outgoing secondary line switches could show some difference.

The average occupancy of the first selectors with respect to the third level would be $2299/10692 \times .594 = .128$ T C. Since 10 outlets will handle 4.13 T C, it will require 4.13/.136, or 32 first selectors to feed each group of ten outgoing secondary line switches. Arranging the first selectors in groups of 30, would give 20 groups, providing a total of 20×10, or 200 trunks to secondaries.

Outgoing Trunks to Office "C":

The average occupancy of the first selectors with respect to the fourth level would be $3546/10692 \times .593 = .197$ T C. Since 10 outlets will handle 4.13 T C, it will require 4.13/.197, or 21 first selectors to feed each group of ten outgoing secondary line switches. Arranging the first selectors in groups of 20 for this level would provide 30 groups of 10, or 300 outgoing secondaries for this office.

Outgoing Trunks to Office "D":

The average occupancy of the first selectors with respect to the fifth level would be $570/10692 \times .594 = .0317$ T C. Since 10 outlets will handle 4.13 T C, it will require 4.13/.0317, or 130 first selectors to feed each group of 10 trunks. There would be four full groups of 130 and a partial group of 80. This partial group will offer $80 \times .0317$, or 2.536 T C, which would require 8 trunks. There would therefore be a total of 48 trunks needed to Office "D."

Incoming Second Selectors:

These can be computed in the same way as described in the first method.

Third Selectors:

It has been found that each group of nine local second selectors will handle 3.57 T C. From this it can be seen that the average occupancy with respect to each of the first three levels is

$$\frac{748}{4280} \times \frac{3.57}{9} = .0694 \text{ T C.}$$

Since 10 outlets will handle 4.13 T C, there will be required 4.13/.0694, or 60 local second selectors to each group of 10 trunks. Since the local selectors are mounted in divisions of nine, each group must contain either 64 or 63 switches. If they are arranged in groups of 63, there would be five full groups, and a partial group of 45, which partial group would require 9 trunks. There would therefore be 59 third selectors from each 1, 2 and 3 levels of local second selectors.

The occupancy of the local second selectors with respect to each of the 4, 5, 6 and 7 levels, would be

$$510/4280 \times 3.57/.9, \text{ or } .0473 \text{ T C.}$$

For each group of ten trunks there would therefore be needed $\frac{4.13}{.0473} = 87$ local second selectors. The total number of local second selectors would therefore be divided into four groups with respect to these levels, thus feeding into 40 third selectors.

Since the average occupancy of the incoming second selectors from Office "B" is .594, the occupancy with respect to each of the 1, 2 and 3 levels is $436/2580 \times .594$, or .1 T C. There would thus be required 4.13/.1, or 41 switches to each group of 10 trunks. These switches may be arranged in three full groups of 40 and a partial group of 25, which partial group may be combined with switches from Office "C." Since the occupancy of selectors with respect to each of the 4, 5, 6 and 7 levels is $318/2580 \times .594$, or .0732 T C, it would require 4.13/.0732, or 56 switches to each group of ten trunks, with respect to these levels. They may thus be arranged in two full groups of 50 and a partial group of 45.

Since the average occupancy of the incoming second selectors from Office "C" is .594, the occupancy with respect to each the 1, 2 and 3 level is

$$588/3292 \times .594, \text{ or } .109 \text{ T C.}$$

It would therefore require 4.13/.109, or 40 switches to each group of 10 trunks. By arranging for four full groups of 40 and combining 15 more with the partial group of 25 from Office "B," a partial group of 10 would be left, which may be combined with the group from Office "D." The occupancy of these incoming selectors with respect to each of the 4, 5, 6 and 7 levels would be $382/3292 \times .594$, or .069 T C, requiring 4.13/.069, or 60 switches to each group of 10 trunks. These may be arranged in three full groups of 60 and a partial group of 5, which may be combined with the incoming selectors from Office "D."

Since the average occupancy of the incoming second selectors from Office "D" is .413, the occupancy with respect to each of the 1, 2 and 3 levels is $90/590 \times .413$, or .063 T C, and the 50 incoming selectors would offer 3.15 T C. Combining this group with the partial group of 10 from Office "C" would make a full group of 60, offering 4.13 T C.

Since the occupancy of these selectors with respect to each of the 4, 5, 6 and 7 levels would be $70/590 \times .413$ or .049, the 50 incoming selectors would offer 2.45 T C. The partial group of 5 from Office "C" would offer $5 \times .069$, or .345 T C, and if this is combined with the group from Office "D," the entire group would offer 2.795 T C, requiring eight trunks to third selectors.

We therefore have in each of the first three thousands the sum of 59, 30, 40, 10 and 10, or 149 third selectors. We have in each of the remaining four thousands the sum of 40, 30, 30 and 8, or 108 third selectors.

Connectors:

For each of the regular hundreds, with 129 B.H.C., it might be unsafe to provide only 10 connectors, so that the third selectors should be arranged in one full group and a very small partial group. This partial group could be combined with the toll selectors, and the trunks led to four combination connectors. This arrangement would provide a group of 10 trunks and a group of 4 trunks, with capacity to carry 4.953 T C or about an increase of 8 percent over the estimated average.

Rotary Connectors:

For 428 B.H.C. of 120 seconds duration, or 14.3 T C, there would be required three groups of 10 trunks to carry 12.39 T C and a partial group of 7 trunks to carry the remaining 1.91 T C, making a total of 37 rotary connectors. To avoid the tedious computation of the occupancies of the various groups of third selectors, it has in this case been assumed that the third selectors could be arranged so that the respective groups of 10 trunks would each have the rated capacity. Since there are fewer than 10 toll rotary connectors, they could be computed as indicated in the first method.

SUMMARY.

In the first method the number of trunks is determined on the basis of independent groups of ten, but the resultant number of switches is so arranged by means of overlapping multiples or common groups of trunks as to afford team work between groups. This extra call-handling capacity is used as a margin to care for possible peak and emergency traffic. This is essential if, as in this case, the busy-hour originating traffic is the basis of distribution, since the peak traffic in any given direction may not coincide with the peak for the originating traffic.

In the second method, each group of

trunks is independent of all other groups and is accessible only from a fixed field. There is no team work, and each group must be arranged to take care of its own peak.

The table below gives a summary of the results obtained in this case by both methods:

SUMMARY.

	First Method		Second Method	
	Number	Remarks	Number	Remarks
Primary Line Switches	6300	....	6300	....
Secondary Line Switches	1260	....	1260	....
First Selectors	600	....	600	....
Local Second Selectors	360	30%*	360	....
Outgoing Sec. L. S. to B	200	30%	200	....
Repeaters to B	130	10%	130	10%
Outgoing Sec. L. S. to C	300	16%	300	....
Repeaters to C	200	10%	200	10%
Repeaters to D	45	10%	48	....
Incoming Second Selector B	145	....	145	....
Incoming Second Selector C	185	....	185	....
Incoming Second Selector D	50	....	50	....
Third Selectors	850	....	879	....
Non-rotary Connectors	640	15%	640	8%
Combination Connectors	256	15%	256	8%
Rotary Connectors	180	9%	222	....
Toll Rotary Connectors	30	....	30	....

*Margin.

For the items where no margin is indicated there is no allowance above that provided in the group variation or probability table. The results arrived at by the first method as shown above would save an initial investment of approximately $4,000, at the same time providing an allowance for emergencies by the use of overlapping multiples.

While the preceding example did not cover the calculations for toll switches and special services to desks, it is felt that the general principles here described can be applied in computing such details of this or any other network.

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BIBLIOGRAPHY.

W. Lee Campbell, "A Study of Multi Office Automatic Switchboard Telephone Systems." A. I. E. E. Proceedings, 1908.

F. Johannsen, "Telephone Management in Larger Cities." Published in Post Office Electrical Engineers' Journal, October, 1910.

E. C. Molina, "The Probability of an Event Happening at Least c Times in n Trials." American Mathematical Monthly, June, 1913.

W. Lee Campbell, "Traffic Studies in Automatic Switchboard Telephone Systems." A. I. E. E. Proceedings, 1914.

F. Spieker, "Die Abhangigkeit des erfolgreichan Fernsprechanrufes von der Anzahl der Cerbindungsorgane." Published by Julius Springer, Berlin, 1913.

P. V. Christensen, "The Number of Selectors in Automatic Telephone Systems." Published in Post Office Electrical Engineers' Journal, October, 1914.

Fritz Lubberger, "Die Anpassung der Fernsprechanlager an die Verkehrsschwankungen." Published by Julius Springer, Berlin, 1914.

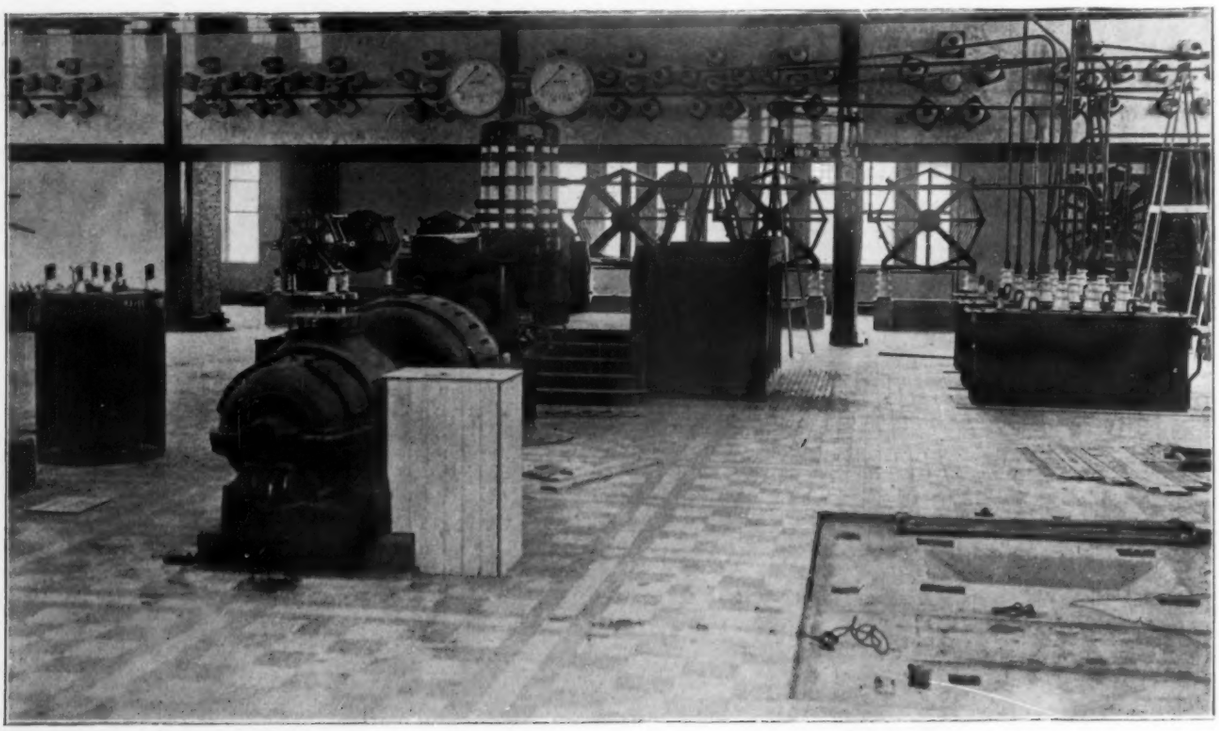
W. H. Grinsted, "A Study of Telephone Traffic Problems." Published in Post Office Electrical Engineers' Journal, April, 1915.

M. Milon, "Determining the Number of Selectors Needed in an Automatic Telephone System." Translated in Telephone Engineer, May, 1917.

F. R. McBerty, "Machine Switching Telephone Gear." Abstracted in Telephone Engineer, May, 1917.

A. K. Erlang, "Solution of Some Problems in the Theory of Probability of Significance in Automatic Telephone Exchanges." Published in Post Office Electrical Engineers' Journal, January, 1918.

W. H. Grinsted, "Theory of Probability in Telephone Problems." Published in Post Office Electrical Engineers' Journal, October, 1918.



Photos by International.

One of the Power Generating Rooms of the Modern Radio Station at Nauen, Germany.

How the Automatic "Carried On"

During a Seventy Days' Strike The Citizens Telephone Company of Grand Rapids Gave Service to 18,000 Subscribers with 17-year-old Equipment

By C. E. TARTE
General Manager.

THERE is only one thing that can make a strike effective in settling disputes between employers and employes, and that is stoppage of production, which usually means stoppage of revenue.

"No organization can be guaranteed against disputes with its employes regarding wages and working conditions but unless a strike will bring about a stoppage of production, with consequent loss of revenue, or pressure exerted by inconvenienced patrons, no employer need have fear of a walk-out. He has nothing to lose."

The Citizens Telephone Company is in a position to realize very thoroughly the truth of the above statement, which appeared on the "Sales Manager's Page" of the August, 1920, issue of *Automatic Telephone*, for today we look back upon a period when, through being able to maintain production substantially unimpaired, we were not forced to accede to demands which, we are convinced, would have been disadvantageous to the telephone users of Grand Rapids, to The Citizens Telephone Company, and in the long run, to our employes.

The past two or three years have been difficult ones for business organizations in general, and for public utilities in particular. The constantly increasiing cost of living has made it necessary to grant higher wages to all classes of employes, while rates, being fixed by elaborate processes of application and hearings, have lagged behind the rising costs of operation, keeping the margin of profit langorously narrow.

The Citizens Telephone Company had given practical recognition to the necessities of the employes, and for several years past its scale of wages were as high as, or higher than in other similar lines in this locality. But the company also recognizes its obligation to its subscribers, to hold operating costs at as low a figure as possible.

Early in August a committee representing our inside and outside plant forces — operators, installers, switchmen, linemen, cablemen, etc., presented a revised wage scale which would have increased our operating costs substantially two dollars per telephone per year. In view of the general downward trend of prices which was already beginning to make itself felt, we were not at all sure that such an increase in wages was needed by men, and did not think it would be just to pass such an increase on to our subscribers so long as any doubt remained on this point.

The Citizens company has always operated on the open shop principle, but has frequently engaged in "collective bargaining" with its employes, so that after explaining our position to the committee, we offered to submit to arbitration the entire question of adequacy of wage and fairness of working conditions, and agreed to abide by the result.

The result of these conferences being unsatisfactory to the employes, they notified the company on Aug. 31, that unless their proposed scale was adopted, they would not report for duty on Sept. 2. Practically the entire staffs of the above mentioned departments failed to report for duty on that day, and for 70 days thereafter, over 14,500 lines of Strowger Automatic equipment, our entire outside cable plant, and about 18,000 telephones were maintained and kept in service by a crew which, except for H. M. Collins, our superintendent of equipment, was composed largely of clerks, solicitors and officers of the company, who had had absolutely no previous technical experience and undertook duties for which they had had no training.

The commercial department was drafted into the switchrooms, the secretary of the company, the auditor and the traveling auditor took charge of the three branch exchanges in the Grand Rapids area, while Mr. Collins with the assistance of three general office clerks, our magneto plant manager, one solicitor, one farmer and one metal polisher, handled the main exchange. All crews slept and had their meals in their respective switchrooms.

This condition continued for the first 23 days, when five men returned to work. These additional men were spread out to the best advantage, although only one of them was an experienced switchman. As the weeks passed we were also able gradually to build up an outside crew which began clearing the accumulation of cable and substation troubles.

The Grand Rapids system consists of a main exchange and three branches, north, east and south. There are just under 18,000 telephones in the area. The equipment is of the three-wire Strowger automatic type, being installed during 1903, and was cut over from manual magneto to automatic in January, 1904.

The original installation consisted of 5,000 lines and additions have been made from time to time, so that there are now central office facilities for 14,500 lines. The first 5,000 lines have been in service seventeen years, and the remaining 9,600 lines have been in operation an average of eight years.

In normal times our maintenance force will repair an average of 150 cases of plant and instrument trouble per working day, thirty of these being dry cell renewals, as we still operate about 8,000 local battery telephones. Until we could reconstruct an outside crew from such help as we could pick up locally and from our magneto plant managers, this trouble naturally accumulated and in the bulk looked rather formidable, but actually did not run very high.

One of our most serious difficulties was that during this time we found it very hard to convince our subscribers that we had no one to repair out-of-order telephones, as the service in general was practically normal.

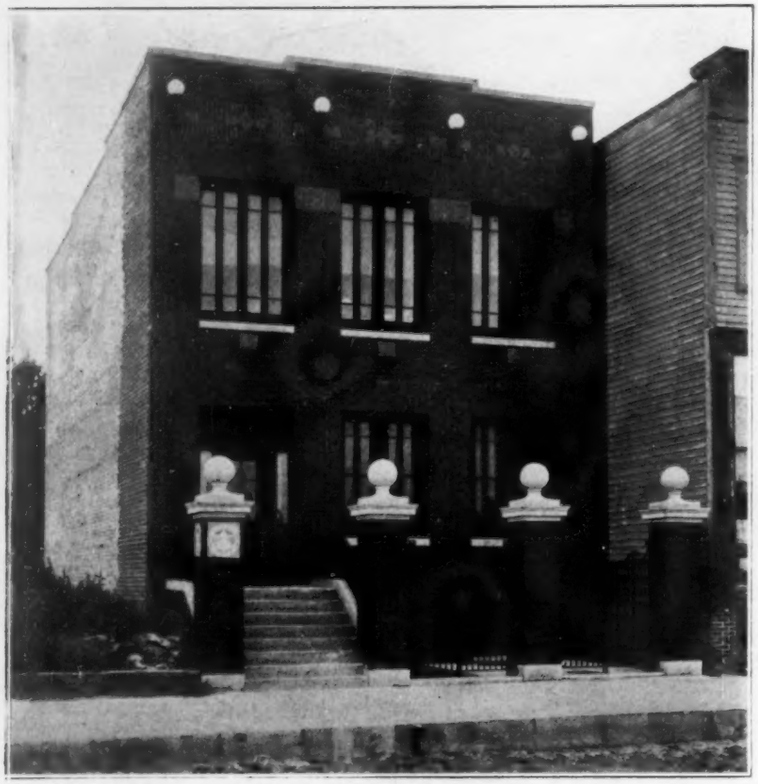
Our traffic, ordinarily heavy, was still further increased because calling subscribers being unable to reach telephones that were out of service, called several times before abandoning the connection. This naturally placed an abnormally heavy load on the equipment, and further aggravated conditions.

But after approximately 2,500 cable pairs were put out of commission through the cutting of cables and jumpers in terminal boxes, which brought the situation dramatically to public attention, our patrons came to understand the abnormal conditions and co-operated with us in every way possible, which was considerable help and gave us the moral support we needed.

Two weeks were consumed in making the necessary temporary repairs to the cable plant, during which time our force had been built up to 40 men. Every available man was then put on troubles, telephones being changed when necessary, as we had only one experienced telephone repair man and he could adjust more instruments in the shop than by sending him out on individual cases.

(Continued on page 26)

Exchange Buildings and General Office Building of the Dota C



Madison Exchange.

Pierre Exge.

Mitchell Exchange.

Main Exchange General

the Dota Central Telephone Company, Aberdeen, South Dakota

Pierre Exchange.

Watertown Exchange.

Exchange General Offices.

Huron Exchange.

(Continued from page 23)

Owing to lack of staff it was impossible for us to keep anything like accurate records, but we estimate that during the whole time our service averaged 85 percent of normal and this is borne out by the fact that for the three months of September, October and November, rebates for non-service ran only about 12 percent of our billings.

During the early part of the difficulty very little attempt was made to make repairs in the central office equipment, because of the fact that most of the force taking care of the equipment was not experienced in this kind of work. Most of them knew nothing about handling a screw driver, a pair of plyers, or a soldering iron. They were instructed to see that switches that were "off normal" on account of grounds or poor releases, were restored to normal, and also see that lines with grounds on them were disconnected at the rack until the grounds were cleared up.

Before the end of the ten weeks, however, these green men had reached the point where they could make necessary repairs on the automatic switches, and at the end of the period, the central office conditions were such that the company did not care particularly whether any of the switchmen came back or not. Those men who were taken back re-entered our employ as though they were new men. No grudges are held against them. The slate has been wiped clear, and we are thinking now only of the future.

But one of the most remarkable things about the whole situation is the fact that after being practically entirely neglected so far as systematic maintenance is concerned, for a period of ten weeks, and receiving only the most superficial attention from inexperienced and inexpert hands, the entire Strowger apparatus was restored to normal within ten days after the regular staff returned to work, and today the equipment is none the worse for the experience.

During the sixth week of the period, our conditions were made more difficult by sympathetic movements on the part of our switchroom and outside forces in our automatic exchanges at Lansing, Holland, Battle Creek and Traverse City, and for five weeks the whole burden of maintaining service fell on the local managers. Conditions at these exchanges were substantially the same as in Grand Rapids, and the results similar.

Too much cannot be said in praise and recognition of the services of the handful of faithful employes who remained on duty, but our knowledge of the inherent qualities of Strowger equipment, lent us the courage to carry on under seemingly impossible conditions.

These ten weeks taught us nothing new about Automatic operation. Our sixteen years' experience with it in Grand Rapids, and up to ten years in five other exchanges, robbed us of any chance for surprises, even though much of the apparatus was in its seventeenth year of service, but perhaps it did give us a new realization of the difference between being dependent upon something that is made and someone that is paid, to do its work.

THINK FOR YOURSELF

Shaw tells us of his visit through the New England States, and his inquiry of a native as to what they did during the long winter evenings:

"Wall, some of us sit by the fire and think, then some of us just sit by the fire." So, in our every day life, we find so many who apparently do not think for themselves.

Original thinkers are scarce; we copy others, their ideas, their customs, their dress, we mimic statements of great men and pass them off as original. It is high time that we ceased counterfeiting and blaze new and original paths through the forests of life's work.

There was plenty for the staff that stood by to do, but if, in addition, they had been called upon to give personal attention to every connection, we would have been powerless and the pressure of public opinion prompted by the collapse of an essential community service, might have compelled us to make a settlement which would have been seriously unjust to all the interests involved.

New York Company Plans Improvements

The New York Telephone Company plans to expend $33,600,000 in 1921 on extending and improving the service. Of this amount $300,000 will be for land; $6,900,000 new buildings; $12,900,000 extensions to central offices and equipment; $7,000,000 outside plant and $6,500,000 for sub-station equipment.

Demand for telephone service in New York City is steadily increasing. On Oct. 1 there were 807,000 telephones in use in the city and it is expected that 985,000 will be in use at the end of 1921.

During 1920 it is expected that 38,700 new telephones will have been installed in New York City. On Oct. 1 there were 83540 unfilled orders for New York City but in 1921 the company expects to install 85,000 telephones here, which means that they will make great headway in catching up.

Proving the increasing use of the telephones in the city, about six months ago the unfilled orders totaled 60,000 against the 83,540 figure on Oct. 1.

Difficulty in getting material has been a basic factor in delays, growing out of war conditions.

Labor conditions in the city telephone field has improved and there are upwards of 14,000 operators at work today.

The company added $40,000,000 to its physical property between January, 1915, and Dec. 31, 1919. During that period the number of telephone stations in New York City increased from 562,551 to 845,440, a gain of 50 percent.

From Jan. 1 to Aug. 31 of this year the company spent $13,396,000 for addition to plant in New York City.

Telephone Wires a Windfall to Belgian Farmers

Telephone wire has been one of the most lucrative crops the farms of Flanders have produced since their fields were made desolate by shell-fire and artillery barrage. And the crop has been a bumper one, yielding an average of twenty bushels to the acre.

When first confronted by the necessity of clearing their fields of the debris and destructive after-effects of war, the Belgian peasants looked rueful. Network upon network of telephone wires, once the lines of communication between the battery positions, observation posts and field headquarters of the opposing armies, were now hopelessly tangled masses of copper, covering once carefully tilled gardens. Before the drudgery of reclaiming the land could be undertaken, these miles of telephone wires must be untangled and cleared away.

But when it became evident that the wire was worth almost its weight in gold in a market shut off for months of its normal supply of raw copper, the peasants went eagerly to their tasks. And when the thousands upon thousands of miles of wire were finally wound up and disposed of, the proceeds were substantially greater than would have accrued from a regulation crop of farm produce. This money, together with the food and clothing distributed by the American Red Cross among the farmers of the war zone, has done much to put these thrifty people upon their feet again, as they bend their shoulders to the seemingly endless task of bringing their shell-pitted farms and ruined homesteads into the semblance of their normal condition.

A Modern Telephone Manufactuer

Where and How Stromberg-Carlson Equipment is Made and the Personnel of the Company

HELPING to give the human voice the range of a continent has been the job of the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, New York, for nearly thirty years. Approximately 2,000,000 telephones have been produced by this Rochester industry, and its work in accelerating business, extending the confines of intimate neighborhood and adding a pleasing, efficient momentum to life's general activities has been one of the mightiest gifts of American industry.

The cave man with his lusty lungs could make his gibberish heard across five hundred yards of water. The megaphone of later civilization increased the range of the voice so that it was able to compass wider streams, but the human voice still was provincial until the telephone was invented in the nineteenth century. Now, by telephonic electric currents, the voice is carried across thousands of miles of space.

LEADER AMONG INDUSTRIES

Stromberg-Carlson is a leader among the Rochester industries that are spreading the fame of this city throughout the world. Down in the diamond and gold mines of South Africa you will find its mine telephones giving underground vaults of natural wealth close communication with each other and with the offices above Stromberg-Carlson switchboards are making swift connections in the large telephone central offices in Shanghai. By use of his Rochester-made telephone, the wealthy Argentian senor can hold frequent conversations over a private wire with his hacienda scores of miles away in the land of pampas. It Italy, Spain, England, Mexico, Cuba, Central and South America, Africa, far-distant Australia and New Zealand—in all parts of the world—Stromberg-Carlson telephones, switchboards, magnets and other apparatus are at work.

ROY H. MANSON.
Chief Engineer Stromberg-Carlson Telephone Manufacturing Company.

It was back in 1892 that two young Swedes, Androv Carlson and Alfred Stromberg, took inventory of an idea, funds at hand to capitalize it, and its hope. They were filled with vision and determination. Each had learned the telephone manufacturing business in Sweden and each had worked on this side of the Atlantic for the Western Electric Company in the production of telephones for the Bell company. With this foundation and an investment of $500 each, they organized the Stromberg-Carlson Telephone Manufacturing Company of Illinois.

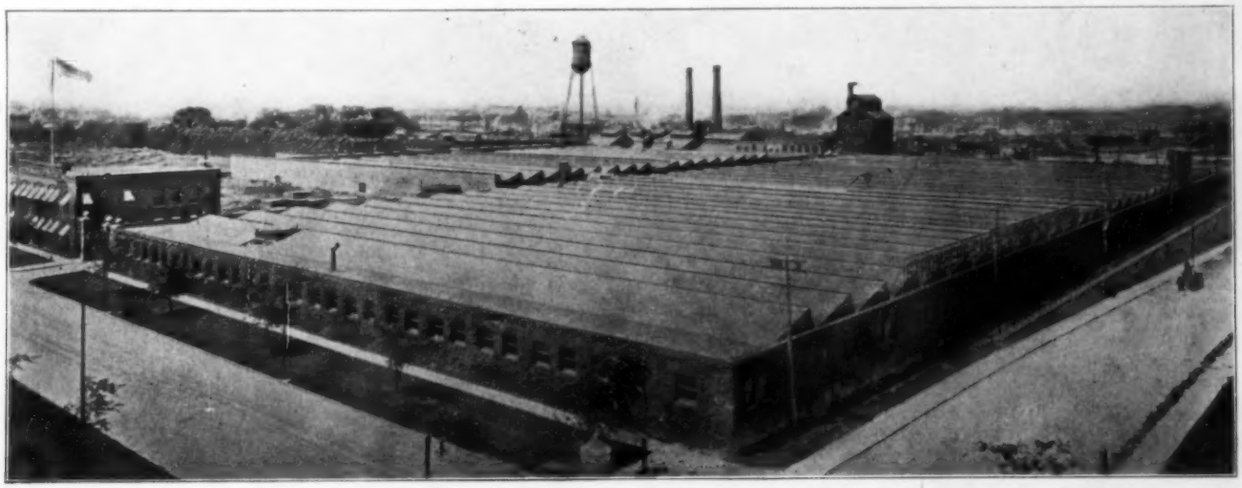
STARTED IN SMALL ROOM

When the company was incorporated in 1895, its plant occupied one room in a small building in Chicago. A historical note made in 1896 informs that the factory had only nine employes and was without either a punch press or a screw machine. But the two pioneers were not discouraged. They plugged on and on and when the great telephone development period came, a few years later, they were ready to reap the harvest.

Independent telephone companies sprang up in all parts of the country. Isolated farmers offered a most alluring field. Stromberg-Carlson salesmen went forth as pioneers and promoters. They were the honored guests, often the presiding officers, at the town-hall meetings called for the purpose of organizing a farmer telephone line. The salesman usually succeeded in organizing the company and, incidentally, the company so organized bought Stromberg-Carlson equipment. Knowledge of parliamentary law then was a prime requisite in a salesman.

GAINED LARGE BUSINESS

Switchboards at telephone exchanges were crude at this period of telephone development and when the multiple board of that time with two or three sections, was introduced it was considered a marvel of size and efficiency. The Stromberg-Carlson Company continually improved its switchboards, as it did all its equipment, and gained a large business. It stepped forcefully into the central-energy telephone field which soon



Plant of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.

Here are many switchboards ready for packing before shipment.

covered all cities, and became a large manufacturer of city telephones for these systems.

The Rochester Telephone Company was formed in 1900 as one of the strongest of the independent companies. With a desire to insure a permanent source of equipment, the men interested in the Rochester company looked around with a view to acquiring a telephone manufacturing company. The Stromberg-Carlson Company looked promising. Negotiations for its purchase were started and in 1902 the newly organized Stromberg-Carlson Telephone Manufacturing Company of New York took over the assets of the Chicago company. The manufacture of telephone equipment was continued at the Chicago plant during the subsequent months but in 1904 the manufacturing business was brought to Rochester and placed in a new plant in University avenue, only a sales branch being left in Chicago.

MADE SWITCHBOARD CABLE

The new plant, which had risen out of an old cow pasture at the end of Culver Park, began industrial life here with the manufacture of switchboard cable cords and magnet wire. New buildings were erected as the company's business grew and was transferred from the Chicago plant. The company now occupies in this plant, which is owned by the Todd Protectograph Company, a little more than half the total floor space, or about 190,000 square feet.

The plant will manufacture this year more than fifty thousand central-energy telephones, more than thirty thousand country, mine and special telephones: approximately fifty large multiple switchboards and about eight hundred smaller switchboards. It numbers among its customers telephone companies throughout the world, great mining companies, individuals, manufacturing companies, the American army and navy and ocean steamship lines.

LARGEST SINGLE SWITCHBOARD

Back in 1906 it built and installed in St. Louis what was the largest single switchboard in the world. This switchboard still is fulfilling all the duties of a great telephone exchange most efficiently because many of the improvements which the company has made in switchboards in later years have been added to it.

In the city of Gloversville can be found what generally is considered to be the oldest central-battery switchboard in existence. This board appears simply to refuse to wear out. This also is true of the private branch exchange switchboard which still is giving service in the Powers Hotel in this city after long years of use.

On a visit to the plant, in University avenue, the visitor sees various products of the company in all stages of manufacture and assembly. Only the best of raw materials are used, and each part and the apparatus as a whole, is tested with great care to see that it measures up to the high standard of quality that the company has set.

Tracing the raw materials used by the company back to their places of origin means taking an extensive world tour. The visitor sees Sea island cotton being braided on to copper wires, celluloid, ivory for telephone number plates, Italian silks of various colors for switchboard cable winding, tin foil made from Straits Settlement ore, rice paper, steels of many kinds, platinum from the Urals, rubber converted from the sap of trees of Borneo, the Congo, or perhaps the Upper Amazon, lumber of oak and mahogany.

One runs into a number of interesting things in examination of raw materials

employed in telephone manufacture. There is aernoid, a substitute for celluloid in the making of key buttons. Aernoid, you learn, is made in England from cow's milk. It is a hard, black, light substance. The layman often has looked at the flat pieces of carbon found in transmitter, receiver and other parts of telephones. In a steamy room out at the Stromberg-Carlson plant, one learns how this carbon is manufactured. The process is a secret one but you are told that coal dust, molasses, sugar and "other substitutes" are mixed and baked.

BRAIDING OF INSULATION

The various materials entering telephonic carbon are all various chemical compositions of carbon and the manufacturing process combines them into a hard carbon disc that is polished highly by two machines made especially for that purpose. The carbon disc is baked or fired nine different times in the making. After being finished into the flat disc required, the pieces are placed in slots of their particular size in the upper, circular plate of the polishing machine. A simple adjustment of the machine presses them down on the lower polishing plate. Machinery is set in motion and the carbon discs or pieces are ground and polished in a manner similar to that employed on the finest diamonds.

Watching several hundred machines braiding insulating silk or cotton on to wire is a fascinating sight. It is the old-time May-pole dance applied as a mechanical operation in industry. The wire is the pole. The spools of silk or cotton that move with bewildering rhythm before it are the dancers paying homage in the established way. Some of the wire used by the company is exceedingly fine—it taking six miles of it to form a pound spool. Such a spool of wire occupies a machine for three weeks or more.

WINDS 100 PAIRS OF CABLES

The winding or braiding of the switchboard cable is done by heavier machines of different mechanism. The company has one machine which winds 100 pairs of switchboard cables at a time. The cotton-covered wires used in these cables are in a variety of colors, running from plain colors to those resembling the warmth of rag carpet. It is important to have different colorings in switchboard cable so as to be able to follow any cable through the mass of cable wire in a switchboard.

The finished cord wire and cable is taken from the spools and dipped in melted beeswax. After dipping, the cable is dried slowly on revolving spools to insure an even spreading of the beeswax. The visitor also sees insulated wire being impregnated with a tarlike compound and condenser coils being impregnated with paraffin. The company has a dyeing department where cotton windings are dyed to the colors desired.

METAL PARTS RUST-PROOF

The metal parts of telephone apparatus are all rust-proofed in the Parker process, which consists of boiling them in a compound that sinks into the surface of the metal and stands as a barrier to oxidization. Parts that will be be particularly exposed to the weather afterwards are japanned or lacquered. All japanning is done by the spray method.

The making of condensers always attracts the layman, who finds it hard to believe that tin foil and thin rice paper can be wound together so tightly from spools without breaking.

The making of tinsel is another operation at the plant that holds the attention of the visitor. He sees wire finer than human hair being flattened out into

Wiring multiple jacks in the switchboard department.

a tinsel ribbon which later is wound about a fine thread to make the flexible conductor of a telephone cord. Ordinary wire in the continual bending of the cord would break, but the tinsel wire will not. The company formerly purchased the tinsel. A few years ago, merchant tailors commenced to use great amounts of tinsel on women's clothes and the company found it hard to get enough. It studied the manufacture of tinsel and installed machines to make it. Now its supply is assured and the quality greatly improved.

MAKES PERMANENT MAGNETS

In a similar way, the company entered the manufacture of permanent magnets. This product was largely made in Germany before 1914. When the war broke, America was shut off from the German supplies, and magneto and other manufacturers using magnets feverishly looked about for some adequate source of supply in this country. The Stromberg-Carlson Company had been making its own generator, receiver and ringer magnets for many years, and finally evolved a satisfactory process for making magneto magnets.

Today the company is the leading manufacturer of permanent magnets in this country. It supplies a large part of the magnets used by companies making magnets for automobiles, trucks, aeroplanes and other gas and electrical apparatus. It thus is having a vital part in automobile manufacture. Its production of magnets during the war was of tremendous importance to the Allies, as it supplied a heretofore German product to automobile, truck and aeroplane manufacturers.

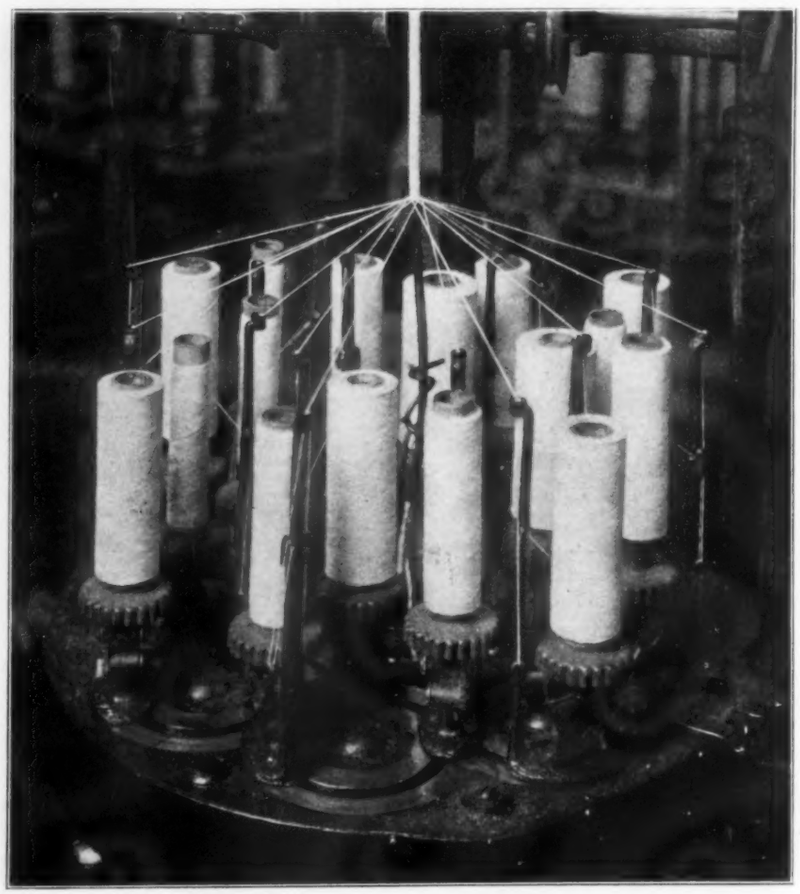
WITH COMPANY FOR YEARS

The company has an unusually large number of men who have been with it for years. These older man occupy places in the plant where their trained hands and active brains will prevent costly mistakes. In the woodworking department a veteran sawyer is seen engaged in cutting up oak lumber. He swiftly, but critically, inspects his board as he draws it along to saw off proper lengths. He cuts out of the board good sized pieces for switchboards, medium sized pieces for wall telephones and small sized pieces for desk-set boxes, and has very little waste left. A poor sawyer either could waste a lot of good material or else let poor material go through. This would slow up operations and perhaps result in the rejection of a finished product. This sawyer has been with the company since 1899.

Continual improvements in production and products are being made. The engineering department works out plans. These are taken into the well-equipped laboratory where they are tested out. If they involve new tools, the large tool department takes up the job of making them. The company now is engaged in a production that involves more than 15,000 separate pieces. Since the beginning of manufacture, more than 35,000 pieces have been used in manufacture and many of the inactive ones are still made at times to supply those desiring them for use on the older apparatus.

HOW LINES ARE TESTED

Great numbers of switchboards and telephones are seen in various stages of production. Young women are working along side of men in the manufacture and assembly of hundreds of intricate parts. They are past masters at tinkering, it seems, working swiftly and with marvelous efficiency. Wires are rapidly strung through the switchboards yet rarely is a mistake made. The cabinets of the switchboards and telephones are largely of oak, though mahogany also is used extensively. The manufacture of these cabinets keeps a large woodworking department busy. The gas ovens used in the magnet department furnaces, in the japan ovens and in doing sundry other manufacturing duties consume more than two million cubic feet of gas annually.



Braiding Machines in Cord Department.

The testing of telephone apparatus is conducted in a most exacting way. Men testing transmitters and switchboard cable are heard monotonously singing:

"Everywhere that Mary went."

CHINAMAN SAYS IT, TOO

These words are sung out by telephone men wherever telephone apparatuses are tested. The tester in Shanghai uses it as well as the tester in New York. Over and over, he repeats it as he throws in various resistances. These were the first words that Thomas A. Edison used in speaking for phonographic record. Edison's voice was successfully recorded in his initial experiment and since that time the singing phrase has been used by telephone men. In testing telephones, however, the tester usually says:

"Hello, Hello, Hello," or "One, two, three, four, five," with emphasis on the "five."

For several years, the Stromberg-Carlson Company has been manufacturing a large amount of telephone equipment for the United States Signal Corps. When General Pershing led a detachment into Mexico in 1916, he kept in touch with this side of the border by means of portable telephone and telegraph sets of Stromberg-Carlson make.

The wire over which he communicated was not erected on pole lines but was simply reeled out on the ground as the detachment traveled south and reeled up again as they returned home. Communication was successfully carried on with him over several hundred miles of fine flexible wire laid on the ground.

MADE PRODUCTS IN WAR

During the war, the company manufactured its products in much larger quantities for the army and navy. It made portable field switchboards, portable field telephones, camp switchboards, camp telephones and gunner sets for use both on land and sea that kept the lines of battle fully and quickly informed of things of moment. Other Stromberg-Carlson apparatus linked up perfect communication systems on warships. The instruments of the Rochester company figured in many historic happenings of import. They were at the elbows of the delegates to the Peace Conference in Versailles. They brought the news of the front lines back to the General Headquarters at Chaumont.

The company is almost without competition in the mine telephone field. Large numbers of mine telephones are made. They have heavy, cast-iron cabinets and their doors are fitted snug by rubber gaskets to insure against moisture entering and destroying the apparatus. These mine telephones are found in mines in all parts of the world and are doing a great work for safety.

The business of the company has quadrupled since 1914. Millions of dollars' worth of telephone apparatus is now turned out annually. It carries on hand a stock of merchandise in the form of raw materials valued at upwards of $1,000,000.

EMPLOYES' ASSOCIATION

A fine spirit prevails in the organization. The employes have an association that conducts a dining room, serving meals at cost. These meals at the cafeteria are remarkedly low in price and consist of good, wholesome food, well served. Hundreds of employes avail themselves of the dinners daily. An organization of employes known as the S-C club promotes athletic, social and educational actvities among the employes and has given to the personnel of the plant a warm camaraderie and highly toned esprit de corp.

The officers of the company include the following: President, George W. Todd; vice-president, Fred C. Goodwin; treasurer and general manager, W. Roy McCanne; secretary, Wesley M. Angle; assistant secretary and credit manager, Edwin C. Roworth; assistant treasurer and auditor, George V. Lennon; purchasing agent, Edward A. Hanover; sales manager, George A. Scoville; export manager, C. E. Heston; advertising manager, Warren B. Eastwood; assistant sales manager, Eugena A. Reinke; chief engineer, Ray H. Manson; assistant chief engineer, E. G. Eidam; general superintendent, S. A. Beyland; assistant superintendents, J. T. McGuire and A. O. Stigberg; master mechanic, G. A. Braddock; chief inspector, W. R. Schall.

Regulation of Telephones in Missouri

The Advantages of State Regulation Pointed Out in an Address Before the Recent Missouri Telephone Convention

By NOAH W. SIMPSON
of Missouri Public Service Commission.

I AM assuming that state regulation is to continue in Missouri. I am a Missourian and you will have to snow me that our great commonwealth is going to take so pronounced a backward step in the march of sensible governmental progress as to abrogate state regulation of the public service corporations of our great state because a few city politicians have been shorn of rights and powers heretofore accorded to them.

State regulation is the final culmination of the divers ways we have attempted to control rates and service of our public service corporations covering many years past, and, in my opinion, any political party or parties that attempt to turn back the dial on modern progress by doing away with the advancement reached and returning to the chaotic business conditions heretofore existing, will be branded by the business interests and clear-thinking people of our state with a stamp of provincialism from which they will be many long years recovering.

Lack of intelligent information and much misinformation characterize the present status of state utility regulation. Like many other scientific and governmental achievements, it has come on us with such imperceptible rapidity that we hardly became acquainted with it until its status was established.

Excepting the subject of railroads, over which the states exercised a limited jurisdictional control for many years, what is now known as state utility regulation is of origin of only about fifteen years, and is now in vogue in all our states. The public service commission act of our own state is only about seven years old, which fact permitted the drafters of our law to write for our state a very superior law, as they had before them for analysis the acts of many other sister states. I have no hesitancy in saying that Missouri has the peer of any utility act in our nation today.

Now, what is the fundamental meaning of state regulation? Stripped of all unnecessary verbiage, it simply means that the state, as a whole, is the basic jurisdictional unit of control instead of allowing each individual political subdivision of the state to act for itself and independent of the other like units in the state.

The political subdivisions are constituted by the incorporated cities of our state; they hold their corporate entity in its entirety at the pleasure of the state, and in practically all matters in time of need must look to the state's protecting arm. Under our form of government the state is and must remain the overlord of these sub-units.

The weapon of the state is the inherent right of sovereignty which it exercises through the great police power for the general welfare of the whole state. These incorporated cities with their governmental functions are nothing more than creatures of the state; it can delegate temporary authority to them, and by like means it can remove from them delegated power when it deems it best to exercise that power itself for the wellbeing of the entire state.

For many years the state tried out the system and theories of permitting these individual sub-units of the state to exercise practically exclusive control over our utilities, and who wants to again return to the old regime of the days of franchise sales and stock and bond jobbing deals with all the attending nauseating disclosures that can be found by an examination of the metropolitan press of those times.

You hear much nowadays about the slogan "Home Rule" for local control of these utilities; but be not deceived, for you are only being presented with the old pill, sugar-coated, to the end that the state loses its jurisdictional control and the city politicians re-establish the old regime.

In every case pending which involves property values, operating expenses, rates and service, there must necessarily be two parties at issue, to-wit, the utility on one side and the local public, which uses and pays for the finished product, upon the other side. Now, casting aside all other reasons, of which there are many, does it not savor of a spirit of fairer justice and better equity to have an impartial state body to fully analyze the whole merits than have one of the parties directly interested in the controversy to render decision therein?

Moreover, the state body is equipped with facilities for intelligent and scientific investigations by covering a large and co-ordinated field of action which many of the sub-units of the state find wholly incompatible with their limited financial resources.

The fixing of just and reasonable rates is vested in the legislative branch of our state government by our state constitution. The general assembly of our state, for obvious reasons, cannot continuously remain in session to try out each individual case, and it therefore delegates and equips a commission to act in its stead in prescribing reasonable rates and the necessary concomitant of service.

There is reserved unto our judiciary, at the instance of any interested party, the right of court review touching the reasonableness of any finding by the commission. The work of our commission has been much assailed by many good, well-meaning people of our state. I can only answer by saying that, in my opinion, they have reached a hasty conclusion not warranted by facts which they would discover if they would investigate properly.

It is unfortunate, indeed, that state regulation had to pass through the crucial period incident to the Great War before it was more firmly established and better understood by the public. It is common knowledge with all that the component elements which go to make up the finished product of these utilities have enormously enhanced in value, yet there are those who would have these corporations continue to furnish their finished product at pre-war prices.

The plain fact is that had not the regulatory body provided increased operating revenues for these utilities they would soon have been in bankruptcy and the consuming public be without any service. To maintain a continuity of service for the public from these utilities required us to increase rates that fell heavily on many communities of our state. No increase in rates has been made only upon careful investigation, but when we found that an increase was imperative, warranted by both law and facts, we acted promptly, fairly and fearlessly as we viewed our duty in the premises.

Another unfortunancy has been that during this particular period a poor quality of service has been furnished by many of these utilities. Increased rates and inferior service are a mighty bad combination. Practically the whole of inefficient service is attributed to labor shortage, transportation and financial conditions, as well as general disturbed economic matters, over which the utility has little control.

Now let us get down a little closer to Missouri utility affairs. The public service corporations of our state consist of the railroad, electric lighting, gas, water, heating, street railways, express companies, sleeping car companies, telegraph and telephone companies.

I have no desire to occupy any time discussing the steam railroad problems. I am one state commissioner who thinks exclusive control over railroad rates should be permanently centered in a central federal body. There is such a gigantic interlocking and overlapping of interstate interests that I came to the conclusion long ago that the building of railroad rates should not be governed by forty-eight masters.

I am a firm believer in the merits of the 1920 Transportation Act, and I hope to see within a few years a consolidation of all the railroads into a few in number, and these properly controlled by the federal government. I do not care to discuss the matter of express, sleeping car and telegraph companies.

The combined investment in Missouri covering electric lighting, gas, water, heating and street railways is about $350,000,000. The gross operating revenue is about $60,000,000, and they have in their employ about 20,000 employes. This shows that our commission has plenty of work on hand at all times, and you will notice that I am withholding discussion of the telephone industry for later on.

Very few, if any, of these corporations are doing what we ordinarily term "making money." Nearly all of them are now having a struggle to meet operating expenses and fixed charges. And yet they must be preserved, for they are giving to the public an indispensable service.

In my opinion, if the owners of all the street car systems of our state could get out of them anything near their original investment, those cities would be without street car facilities, unless they built them themselves.

The same thing may be said of the steam heating companies and the small gas companies of our state. What is to be the solution of our Missouri street car problems is an enigma to me.

Within the last few weeks the street car company of Kansas City has been forced to run up the white flag and pass into a receivership. The cause therefor, almost in its entirely, is attributable to an unfair and unjust fight that has been waged against it for a long time. By steady accretions the mind of the public, many of whose daily vocations make them practically dependent upon the utility for transportation, have unfortunately been educated to the fallacious conclusion that it is their duty to reduce this system to a degree of impotency.

I make these recitals not in a spirit of criticism but to sound the tocsin that, in my opinion, the time has arrived when public community thought must face about on these vital propositions, unless they want to completely lose this public service.

The accusation against these utilities of sins of omission and commission in days past, before state regulation, will in no instance suffice to meet the issues governing the present day. They are now under complete regulation and their investment value is fixed by law at its present fair value.

I would like to discuss further the relative conditions of other of these utilities, but time forbids me from entering into analytical discussion thereof. Let is suffice in passing to say that one of the imperative requirements of a public service corporation is to maintain its yearly status in such a healthy condition that it can finance itself, covering extensions, betterments and improvements, by being able to attract capital to make investments in its security issues.

Unless it is able to meet this necessary requirement, it soon passes from an active, going business concern and, in the end, all must suffer the loss. At the present time I consider the electric lighting and telephone utilities as occupying the best, most healthy positions in our state. They both occupy fields susceptible of great future development and are more universally utilized than any other combination of utilities.

The electric companies are now rapidly reaching out to traverse practically all sections of our state through the initiation of central energy plants and high tension transmission lines. It seems to be the practical solution of the problem to carry full-day electric service into all the homes of our state, but the situation creates a community of interest between the telephone companies and the electric companies that warrants careful co-operation and investigation between the companies and the regulatory authorities.

While I have enjoyed my work of investigation incident to all utilities covering about four years' work upon our commission, I must say that the telephone problems have appealed to me

with unusual interest. It is a public utility that gets down close to the business and home life of all classes of our people as they journey down the busy pathway of life. Its field of usefulness for the present is only surpassed by its possibilities for the future. We must never let it pass from its peculiarly allotted position of being an integral part of the every-day business and home life of our commonwealth.

At the present time we have in Missouri telephone investments of about $65,000,000. If we could divide our state into families of six persons, each family would have a telephone. We have seven Class A companies having an annual income of over $250,000; three Class B, with incomes of over $57,000; twenty-seven Class C, with incomes of over $10,000, and 453 Class D, with incomes less than $10,000 per annum. There are about 13,000 employes, 8,000 females and 5,000 males, and the present average monthly salary per employe is about $90.

Now, of these companies many had to have rate increases to meet the increased prices of material and pay increased wages to their employes in order to get up to the present average monthly wage of $90. For this, our commission received much criticism.

Criticism is ofttimes given before the critic investigates the subject upon which he is delivering his preachments. It is an easy position to occupy in life to drift along with the current and be a faultfinder with the actions of those whose duties require them to take the initiative.

Without wanting to tire you with any statistical data, I am going to read to you an excerpt from a very interesting pamphlet recently issued by the Illinois Committee on Public Information. I think it is self-explanatory and I will satisfy myself by simply reading:

NEWSPAPER PRODUCTION COSTS.

	Percent increase Jan. 1, 1920, over Aug. 1, 1914.	Adnl. pct. increase Sept. 1, 1920, over Jan. 1, 1920.
Print paper	212.50	48.75
Ink	200.00	16.55
Metal	108.00	*4.00
Machinery, equipment	104.00	20.00
Twine	225.00	*3.55
Labor	91.55	10.87

*Declines.

Paper and labor are the largest cost of a newspaper.

GAS AND ELECTRIC COMPANY PRODUCTION COSTS.

	Percent increase Jan. 1, 1920, over Aug. 1, 1914.	Adnl. pct. increase Sept. 1, 1920, over Jan. 1, 1920.
Bituminous coal	126.06	37.5
Anthracite coal	152.77	3.19
Coke	103.53	101.23
Gas oil	200.00	83.33
Oxide	110.53	15.00
Fire brick	140.00	27.78
Pipe	148.82	19.63
Labor	79.88	21.35

Fuel and labor constitute more than two-thirds of the operating costs of these companies.

TELEPHONE COMPANY PRODUCTION COSTS

	Percent increase Aug. 1, 1914, to Jan. 1, 1920.	Adnl. pct. increase Jan. 1, 1920, to Sept. 1, 1920.
Labor	74.5	11.8
Poles	140.0	4.5
Switchboards	129.0	17.0
Instruments	62.0	15.0
Hardware	193.0	16.0
Wire	95.0	10.0
Lead	84.0	16.0
Paper for cables	112.0	20.0
Steel	91.0	3.0
Glass insulators	99.0	6.0

PRODUCTION OF ELECTRIC RAILWAY COMPANIES.

	Percent increase Aug. 1, 1914, to Jan. 1, 1920.	Adnl. pct. increase Jan. 1, 1920, to Sept. 1, 1920.
Girder rails	69.9	7.8
Pine ties	170.9	*0.3
Wheels	115.0	2.4
Glass	189.0	5.1
Transfer paper	341.9	52.64
Brake shoes	83.3	15.42
Trolley rope	239.6	7.32
Axles	319.4	*0.8
Malleable castings	241.7	24.4
Yarn waste	106.0	4.85
Pinions	96.7	7.40
Track salt	80.0	27.5
Granite paving blocks	34.0	16.3
Sand	125.4	25.0
Cement	69.5	4.3
Wood insulators	221.0	4.4
Bonding wire	69.5	2.5
Tie plates	202.5	14.5
Switches	70.7	15.9
Trolley wire	44.9	6.2
Trolley poles	159.9	40.4
Spikes	167.3	8.45
Labor	165.5	90.5

*Decrease.

Labor is by far the greatest cost in the operation of a street railway.

Newspapers have increased their subscription rates from 100 to 200 percent and their advertising rates from 50 to 150 percent. This was done without any state regulation.

What we need today in Missouri is a more complete standardization of telephonic exchanges, rates and services, beginning with the telephone business in our metropolitan cities and going down until we include our Class A rural service.

During the short time of government operation of the telephone systems there was established a major standardization of toll rates, and it is unfortunate that some character of standardization was not inaugurated covering other phases of the business.

The basic view of the whole of the telephone rate fabric in Missouri is that it is built upon that wasteful, extravagant plan commonly known as flat rates. Practically all other service utilities have been able to cast aside flat rate charges, but the telephone business appears to be required to still march on loaded down with this indefensible vice.

I suppose no class of utilities has made such stupendous scientific advancement of its art as have the telephone industries, and yet, in the face of all these remarkable achievements, this old bogy of flat rates hovers over the telephonic business of our state like an exacting nemesis.

What could be more unreasonable or ridiculous, viewed from any sensible business standpoint, than that two telephone subscribers, one using 1,500 calls a month and the other using 300 calls, should both be charged the same monthly rental for service?

As I view the future, I come to the irresistible conclusion that basic reforms of the business will come from:

(a) A universal primary fixed charge against each class of consumers, followed by a sliding scale measured rate equitably bottomed upon the monthly call consumption of each patron.

(b) The installation of mechanical, automatic service where the exigencies of the surrounding conditions will warrant the financial investment.

(c) The elimination of the abominable free exchange service, but the levying of only a small charge in lieu thereof for the purpose of eliminating the present abuse of free service.

And now, in conclusion, I want to say a few words about rate cases. Within the next few months I look for the United States Supreme Court to finally decide what are to be the base unit values to be used in reproducting new inventories and appraisals.

When that much desired end is reached, you ought to have a value placed upon all your property in accordance with the law, so you will have a permanent base upon which to build your future business. All your cases should be presented to the commission by detailed, exhibitory evidence, which should first be submitted to local authorities, as is now done by the Class A companies of our state. Some of the Class D companies of our state have their maintenance and depreciation accounts so intermingled that they could not recognize their old friend "Depreciation Reserve" if they met him coming down the road under a heavy military guard.

The rural Class A switching service gives the commission much trouble and annoyance. If I had my way about it I would under no instance allow over eight stations on one of these rural lines, and then I would not permit any company to connect them until the whole of the line was put in serviceable condition.

Cutting Costs By Saving Cancellations

Some Practical Suggestions By a Writer in Ohio Telephone News on Lessening the Number of "Take Outs"

IN both large and small exchanges where the residence subscriber has ordered out his telephone because of temporary absence from the city, probably all of our companies have saved a good many instruments by giving half rate for the time that the subscriber is away, leaving the instrument on the premises but shut off from service.

Wise companies do not allow the telephone to remain in vacant places of business. However, in view of the present house shortage they no longer remove them from every residence as soon as it is vacated, and this statement applies both where people are leaving town and where they are simply moving elsewhere in the city. In some exchanges the scheme has been adopted by which as soon as they learn that a business subscriber wishes his telephone moved to another part of the city, a company representative visits the premises to determine whether it is a safe and desirable place to leave the old instrument. If he does not consider it such, the instrument is removed. But if the place is a perfectly safe one, a tag is attached to the instrument inviting the tenant to call at the company's office and sign an application for service.

Where a residence subscriber moves from a house and discontinues altogether, the company as in the other case investigates, and if it is a proper place to leave the instrument, a tag is attached to the instrument.

Instruments left on premises should be given keen oversight by reliable employes, who watch the premises carefully by either visiting them or calling up over the telephone, and as soon as a new tenant appears, if he is an old subscriber moving in, the telephone is ready for him, if necessary the service being changed if it is not the quality desired.

Fifty-nine percent of one company's telephones left in vacant premises, which is 32 percent of all resident telephones ordered out, were either taken by new subscribers who were led to subscribe because they got "the telephone habit" or were used for old subscribers moving in.

The work of the agents of this company for four months was as follows: The percentages given, being the percentages based on, not the whole original number of telephones in vacant houses, but on the number left in after investigating the premises.

43% of the telephones left in vacant residences were transferred to new subscribers.
16% were transferred to old subscribers, moving in.
41% refused to subscribe, and instruments were taken out.
100%

You will note that the practice saved 43 percent of the telephones which were left in vacant premises, by inducing new tenants to take the service, not only adding these subscribers to the list but saving the construction expense.

Regarding the preventing of disconnections in smaller exchanges where the use of solicitors or sales representatives is not justified, the same rule will apply, namely: Don't take out a telephone if you can possibly save it. It is the old principle adopted by all good business men in every line of business. Even the baby in its cradle will not let its stick of candy go without a vigorus protest. If you send word to the grocer that you are not going to trade with him any longer, he is going to find out, if he is enterprising, whether you are going to leave town or whether you have some complaint, and in the latter case he is going to do all he can to retain your business. And if you are going away and someone else is taking the house he is going to have the order man look up the new people. If you find a subscriber is giving up the telephone for financial reasons persuade him to continue it as it is for a while longer until things get easier with him; or if that cannot be done possibly an offer of a lower grade of service may catch him. If he has a grievance you will naturally straighten it out. If there is a complaint of the service the manager's pride should not permit him to have it said that he ever lost a subscriber for poor service. Instead of taking the telephone out of a residence which has become vacant, leave it in; learn from the real estate agent who is going to occupy the house and then get after the new people for service. You will get splendid results. If you accomplish nothing with the new people it is very likely that some neighbor has been using the instrument more or less, and rather than see it go out of the neighborhood he will subscribe for it, and thus a subscriber is saved.

One telephone manager discussing "take outs" recently said, "the disconnection of a subscriber has a bad effect in a small town, and going along a village street to the office with a telephone causes remarks to be made by your fellow citizens such as 'You're losing a subscriber, who's giving up their telephone? etc.,' and the moral effect of this is bad. It gives me such keen anguish to have to disconnect a subscriber that I choose the time for the street parade to the office when the fewest citizens are to be met and after dark is my favorite time. When I obtain a new subscriber I take special pains to go down the principal street with the instrument under my arm and with a broad smile on my face."

When a subscriber writes the company that he is leaving the city temporarily or even permanently and wishes his telephone taken out, it is a very graceful and business-like thing to do to write him a letter of acknowledgment, expressing regret, thanking him for his past patronage, and expressing the hope that he may become a subscriber again. Such a letter, even if he has been an unreasonable subscriber, makes him feel kindly towards the company.

Regarding disconnections for nonpayment, one manager expresses it this way: "Deadbeats are plentiful in every locality and the merchants generally have them listed. Some people never make any pretense at paying bills and these are just the class of subscribers we don't want. I have known people who have never paid any bills except when they were on the verge of a trip to the court house, and these same people always paid their telephone bills promptly, but they are undesireable patron, as they will get us in the long run."

Another writes: "My experience has been about as follows: That by an especially good man visiting the people we save a small percentage of non-payments, a very large percentage of complaints of service or grievance orders; but only a small percentage of the people who feel they have no further use for telephone service. On the question of complaints of service or grievance of any nature we can save the largest percentage because we can generally remove the cause of complaint or adjust his grievance, no matter what it may be; but when a man has made up his mind that he has no further use for his telephone, it is a rare case when you can talk him into retaining the same; even if he only drops his service for one month. This we have a number of cases of, and as the wheel of time revolves we generally secure again the man who had service and dropped same because he had no further use for it."

Quoting another manager's letter in regard to saving subscribers who are

ordering their instruments removed "for service complaints," there is most emphatically a remedy, and that would be for the manager himself to interview the dissatisfied subscriber and endeavor to get him to continue the service for just another month for the purpose of noting the improvement. After such an arrangement with the subscriber, the operators should be instructed to give such subscriber the most careful attention; not necessarily to the detriment of other subscribers, but by making a special effort to be pleasant and prompt.

The subscriber who is given to complaints of the service, is usually a person who has absolutely no idea as to the manifold duties of an operator, and who does not begin to comprehend the operation of a switchboard. With such, it is an excellent plan to have them call for an inspection of the operating room and the plant generally, selecting for the visit a time when the switchboard is normally busy. I find that after such a visit the subscriber usually discovers that he is but one small atom of an enormous and extremely busy piece of mechanism, of which each piece must do its part of the work with dispatch and good nature. I firmly believe that a greater number of our service complaints can be traced to the subscriber himself, and if he is once shown that he is really as much a part of the system as the operators, we will never hear from him again, unless, of course, something out of the ordinary happens. And not the least important item with such subscribers is to have them interviewed by the highest company representative within reasonable command."

Another writes: "The causes of all disconnections should be thoroughly investigated by managers to ascertain whether the fault lies with the telephone company or not. If it does, a personal visit should be made by the manager, the matter gone over carefully, and the trouble adjusted then and there if possible. This not only gets us in the good graces of complaining subscribers, but tends to promote friendly relations in the future. I believe that many a take out passes a manager's office and he never gives it a thought whether the telephone is taken out for bad service or for some other defect, whereas a little thought applied in the right place would in a great many cases save some of the business for us. The same district manager adds something to which I believe all of us would not feel like subscribing. "I believe that operators are in a majority of cases responsible for people having their telephones disconnected; this comes about by operators giving bad service and incivility coupled with it. Such service greatly reduces our business. Managers should see to it personally that operators of a saucy, surly and snappy disposition are quickly removed from the service and ones put in their places who are accommodating and treat the public with respect.

"A telephone company doing business without any discipline in its operating room is bound to lose its patrons. The greatest remedy to keep take outs down to the minimum is to give the people 'satisfaction' in all departments; this friendly feeling and the spirit to look after every subscriber's wants are two of the greatest items that go to increase our business and help us hold that which we already have."

Another says: "I have never received a good legitimate complaint from any of my subscribers ordering their telephone disconnected but that I could in some way get them out of the notion; for that reason I have never lost a telephone for complaint of service. It is my opinion that if the manager would look closely to his service there would be fewer take outs from this cause.

Regarding telephones ordered out because of no further use. One manager states that the majority of such people have the telephone replaced when they return, if the disconnection was made owing to the sbuscriber's leaving town, so that they cannot be considered permanent losses. He says: "I do not know the experience of other companies, but with us we regain in most cases the subscribers who give up because of no further use, unless they leave the city."

On the subject of "telephones not needed," a manager puts it this way, and makes a suggestion which is worthy of consideration.

"The 'don't need' class is a large one and may be subdivided: It contains people whose business has decreased or changed in some way so that they have less use for a telephone than before, and some who have just as much use for it as ever, but have not been able to realize that it has been useful to them to the extent of its cost. It seems to me there is room among this large class to head off some cancellations by showing some of them how to make use of a telephone.

"The question as to whether a telephone pays or does not pay is one that cannot always be solved in plain figures, but is largely a question of judgment on the part of the subscriber. He generally errs if at all on what he thinks is the safe side, and has his telephone taken out. In selling tools or machinery, directions for use are helpful to those who are to use them. Could not some 'directions for use' accompany telephones so as to encourage people to try to get their money's worth out of them and thereby prolong the term of service and stand off the cancellation because of 'does not need'?"

Standard Underground Pacific Coast Changes

The Standard Underground Cable Company of Pittsburgh announces the following changes in its Pacific Coast staff.

Mr. Richard G. Harris succeeds as Pacific Coast manager, Mr. John B. Bell, who will hereafter devote his time to the growing demands of his export and import business.

Mr. Harris has been connected with the Standard organization since 1909 when he was a member of the staff of the general offices of the company at Pittsburgh, and on special development matter at its Perth Amboy (N. J.) factories, and later sales engineer with the New York office of the company. For the past eight years he has been manager of the Montreal office territory of the Standard Underground Cable Company of Canada, Ltd. His experience, together with his training as an electrical engineer, qualifies him for efficient and experienced representation and management of the Standard company's interests on the coast.

Mr. Vinton Smith, who has been connected for several years with the San Francisco office staff, has been appointed assistant Pacific Coast manager. Mr. W. G. Stearns, also for many years with the company on the coast, has been appointed special sales agent.

New Directory and Market Data Book

Crain's Market Data Book and Directory of Class, Trade and Technical Papers, now on the press, promises to be of unusual interest to advertisers generally and users of trade and technical papers in particular. It not only lists all of the business publications of the United States and Canada, giving circulations, rates, type page sizes, closing dates, etc., but supplies a market analysis of each trade, profession and industry. Thus the reader is given the basic facts of each line in which he may be interested, including its buying power, buying methods, character of requirements, etc. The volume, which is bound in cloth and contains nearly 500 pages, is published by G. D. Crain, Jr., 417 S. Dearborn St., Chicago. The price is $5. Orders in advance of publication are being accepted at the rate of $3.75.

Utility Public Ownership A Failure

State Officers at Their Annual Meeting in Washington, D. C., Favor Private Utility Control

The National Association of Railway and Utilities Commissioners is composed of the members of the commissions constituting the regulatory bodies in the 45 states of the union that have commission form of regulation of the utilities which render service to the public. Being state officials, having no private interest in these essential companies, jointly entrusted by the various commonwealths with safe-guarding the public's interests and being in a position to make a deep and continuing study of the problems affecting the nation's utilities, which have an investment of $15,000,000,000; hundreds of thousands of securities owners; hundreds of thousands of employees and upon whom nearly two-thirds of the nation's citizens are dependent for daily services, the composite viewpoint as presented by the report should be of much value in reaching correct conclusions on the subjects presented.

WE, your committee on "Public Ownership and Operation," from which, in accordance with custom, a report is expected, beg leave to submit the following as its report on the general subject embraced in the title of this committee:

The question of private ownership with regulation as against public ownership without regulation should no longer be considered by intelligent investigators an open question.

We think it may be admitted as a general proposition that public ownership has failed wherever it has been properly tested. We recognize the fact that in some special locations public ownership and operation may appear to be successful, but we hold that if the real facts might be ascertained and the same test applied to the publicly owned and operated utility as is applied by regulatory bodies to the privately owned and operated utility, the general result will apply in all instances.

We need no better illustration of the result of the attempt of the public to operate utilities than the recent operation of the railroads by the United States government.

These roads were taken over pursuant to the war power of the government and operated by the director general with such autocratic power and independent irresponsibility that the financial and other business interests of the country wondered what, if any, limitations really existed and in what forum conflicting claims of right might be adjusted, if indeed there was any forum of appeal from the will of the supreme operating authority. In fact, or at least in practice, there was no limitation on the power of the director general and he operated these utilities as a unified system with full power and authority to make and change all rules and regulations to accomplish the most beneficial results. The rate of wages and the rates to be paid by the shippers and the rate of return to the owners of the property were arbitrarily fixed by the national government and a full and free opportunity was given to test the competency of public operation in the interest of the public and the efficiency of the service so rendered.

The result is common knowledge. As the necessity which gave rise to the assumption of federal control and operation approached a conclusion, the question of returning the roads to their owners and the manner and method of turning them back became such a complicated question that the situation became similar to that of the man who had hold of the bear—he was unable to hold on and feared to let go. They came back to their owners in a broken and disorganized condition and it was necessary for the national government to create a fund which might be loaned to the railroads for the purpose of rehabilitating them and restoring them somewhat to their normal condition before government operation began.

In addition to which, since they have been returned to their owners, there have been increases in freight and passenger rates, until the public is today paying the highest rate for freight and passenger transportation in interstate traffic that was ever charged by the railroads, and more than the most optimistic railroad president dreamed would ever be their lot within as late a period as five years ago. Is there any reasonable and thinking man who has paid the slightest attention to the subject matter who can be heard to maintain the doctrine that government operation, not to speak of government ownership, was a success?

OTHER UTILITIES DIFFERENT.

In the field covered by the other utilities—street cars, electric light and power, telephone and telegraph, gas and water—there has not been the same opportunity to make the character of test as was made with the railroads. These latter utilities came upon the field at different times through process of invention, and, being a new enterprise and a new business, each in its turn was obliged to create the demand for the product it served or the service it rendered. In the early years the public was not interested in either.

With such utilities as required municipal permits or franchises, the matter was conducted by the officers of the utility representing the demands or necessities of the utility company on the one hand and the municipal bodies controlling the use of streets and public avenues, and representing the public at large, on the other.

Each party was dealing with the other to secure the best advantage possible for the interest which it represented. There was no independent, disinterested and honest effort to ascertain what should be a just and reasonable rate to which the utility should be entitled and at the same time protect the public, until the advent of the regulatory commissions.

When the commissions took hold of the situation the result in many instances was a lowering of rates, and the commissions were correspondingly popular. Since the outbreak of the war, with the enormous increase in the cost of labor and all materials entering into the construction and operation of utilities, the commissions have been confronted with the necessity of meeting these advanced costs in order to permit the utilities to function, and in different sections of the country there has originated a demand for municipal ownership on the part of those who think or believe that the commissions should compel or seek to compel the utilities to operate at the rates which were prevalent prior to the outbreak of the war.

SOME REMARKABLE FACTS.

It seems remarkable that any sane man with a knowledge of the increase in all costs of living should think or expect that utility corporations might be an exception to the general rule. No reasonable man has thought so.

The operation of these general laws has again produced the political agitator, who has sought and is seeking to make political capital out of present necessities. We all know him and we all understand his motives.

It is remarkable that the public at large should not also recognize the impossibility of doing business today at the cost of doing business prior to the war. It is remarkable that men, honest and reasonable in the conduct of their own business affairs, will accept as gospel truth the perverted, even dishonest statements of the demagogue who seeks to climb into power and prestige by denouncing the increased rates allowed to utility corporations by the state and national regulatory commissions.

It is remarkable that the public has not sufficient appreciation of the constitutional limitations and the constitutional restrictions placed upon the attempted confiscation of private property for public use.

It is possible that in some communities, indeed in some states, the laws creating the regulatory commissions may be repealed by reason of the weakness of the legislative power to withstand the demands of the demagogue; but in those communities and in those states we believe the state and federal courts will protect the rights of those who have invested their money in the securities of the utility corporations, and compel the authorities to permit the collection of just and reasonable rates.

REGULATION VS. INDIVIDUALISM.

The question which confronts such communities and states is the question whether they will permit the regulation and control of these vast interests by regulatory bodies created under state law, or whether they choose to permit the utilities to establish their own rates as just and reasonable, protected by the injunction of the state and federal courts.

It is most natural in this condition of affairs that the demagogue and the dreamer should invoke the doctrine of public ownership and public operation.

We have seen it made the issue and apparently honestly urged by men reasonable and sane in all other matters, but who hope that by some process of legerdemain to continue to pay constructive costs, high wages and other advanced costs of operation, and yet continue to operate the utilities at the same price for the product or service rendered as was in vogue prior to the World War. Some are honest, we are forced to believe, and others are not.

The argument is generally advanced that in the early construction days of the railroad and other utilities the public was defrauded by wildcat financing, and as a result thereof public opinion is prejudiced against utility corporations in general. These charges may or may not be true and it is not necessary for the consideration of this question to review them. We know that under the present system of public regulation these abuses can no longer exist.

WATERED STOCK ABSENT.

We know that as a result of the depreciation in all values resulting from the great war that any "water" which might have existed in these properties has been squeezed out and cannot get back in.

We have noted many changes in the functions of the government during these later years and many enterprises and duties have been assumed by the state and national governments which were not dreamed of by the founders of our system, and it may be necessary to continue the experiments even to the extent of taking over the utility corporations in order to convince the public at large that such is not the proper method and manner of operating them.

It stands to reason that no business enterprise dependent upon the varying changes of political thought can be operated by the public in as efficient, methodical and careful a manner as can a similar business enterprise managed by a body of men who have their capital invested therein, or who represent those who have invested their fortunes therein.

It may be necessary in order to further demonstrate this fact that the public will demand a further extension of the experiment of municipal ownership or municipal operation. It is being tested in some of the European countries today; it is demanded in this country by those who would destroy our government system and substitute some system similar to that which is said to operate in Russia.

There are two classes of people opposed to private ownership with government regulation.

RADICALS AGAINST LEGISLATION

One is made up of the classes of the communist, the anarchist and all others who follow the divers and various governmental vagaries with which they seek to supplant our constitutional government. The other general class is the dreamer, the visionary, the professor who deals in ideals, but not facts, and who is opposed to private ownership and governmental regulation because they both feel that should this process fail nothing will remain but public ownership and public operation, and we believe they are correct in that view.

Destroy private ownership with public regulation and the next step is government ownership and government operation. When that time comes, if it does, our system of government will have changed to meet it.

We will not be living under the system of constitutional government which we now enjoy because these properties cannot be taken over and honestly paid for through any series of bond issues or otherwise and operated as efficiently and economically as they are now operated in the hands of their owners.

In order to take them over and operate them at a less cost than their owners can operate them, it will be necessary to confiscate all or a large portion of the actual value of these properties, and if that can be accomplished it will be notice to the world that our constitution has changed, and that our courts are no longer able or capable of protecting private property from public confiscation.

It is no less immoral to take private property for public use without making just compensation therefore than it is to take private property for private use under the same or similar circumstances.

We believe that the present system of private ownership and private operation with public regulation as is now the custom in this country is the proper, logical and indeed the only just and honest manner of conducting the public utility business of this country.

Extensions to System of Chicago Telephone Co.

More than 200,000 subscribers were added to the service of the Chicago Telephone Company in an order issued at Chicago by the public utilities commission, approving the purchase by the company of the property of the Central Union Telephone Company in Illinois. The stipulated purchase price is $15,500,000. The Central Union supplies local telephone service to cities and villages in the state outside of the eight counties directly adjacent to Chicago. The Chicago Telephone Company plans to reorganize under the name of the Illinois Bell Telephone Company. By the time the transfer is completed, six months from now, the company will have approximately 1,000,000 subscribers, officials told the utilities commission. The Central Union is selling its property in three states to raise $40,000,000, the amount of its indebtedness to the American Telephone and Telegraph Company. The Illinois utilities commission was told that the company expected to raise $24,000,000 from the sale of its property in Ohio, and from $5,000,000 to $7,000,000 in Indiana.

Ernest B. Fisher Passes Away

The Grand Old Man of Independent Telephony Dies at His Home in Grand Rapids, Mich., on December 16, Aged 73

ERNEST B. FISHER, one of the best known and most loved men in the Independent telephone field, died at his home in Grand Rapids, Mich., on Dec. 16 in his 73rd year.

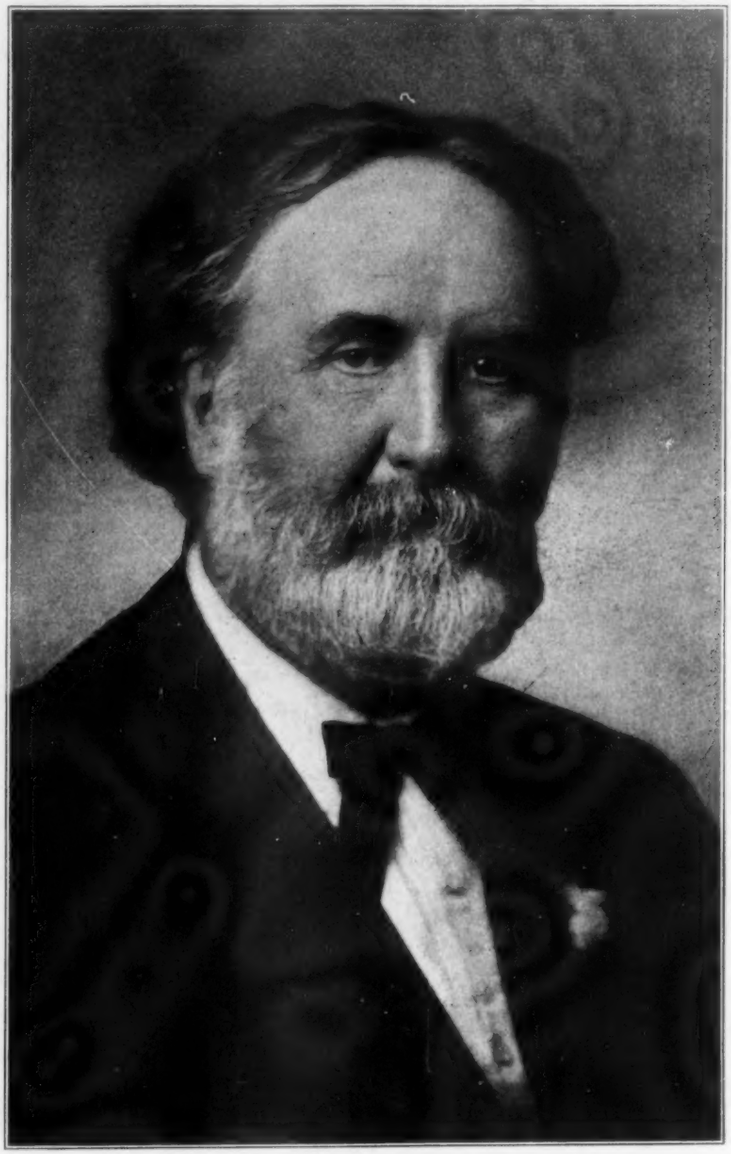
Born in Binghamton, N. Y., in 1847, Mr. Fisher removed with his parents to Oshkosh, Wis.; then to Beaver Dam, Wis., and later to Broom county, New York. Five years later he went to Michigan, teaching school in Oakland county for two years. In 1869 he removed to Grand Rapids, where he taught school and worked at the carpenter and lathing trade.

Two years later Mr. Fisher became interested in newspaper work, and started as reporter on the Grand Rapids Eagle. He gradually worked his way up until he had been city editor, business manager, and finally occupied the editor's chair. While in that capacity he aided many civic enterprises and was active in helping the progress of the city. His editorials were widely read.

Mr. Fisher retired from newspaper work when the Eagle was sold by the late A. B. Turner to E. N. Dingley of Kalamazoo.

Later he became a charter member of the Grand Rapids Board of Trade, and was active in furthering the industrial progress of the city.

He was also a member of the board of education for eight years, being president of that body during his first two terms. He was also a member of the national commission of the Columbian Exposition in Chicago in 1893, was the first president of the Citizens Telephone Company, which he helped organize, retired as its secretary in 1914, served a mayor of Grand Rapids in 1894, was chairman of the board of directors of the United States Independent Telephone Association since 1915.



Ernest B. Fisher, Born 1847, Died 1920.

For twenty-five years Mr. Fisher has been a prominent figure in Independent telephone circles, more particularly at state and national conventions where he was most active in the proceedings and gave much valuable advice from his knowledge of telephone conditions.

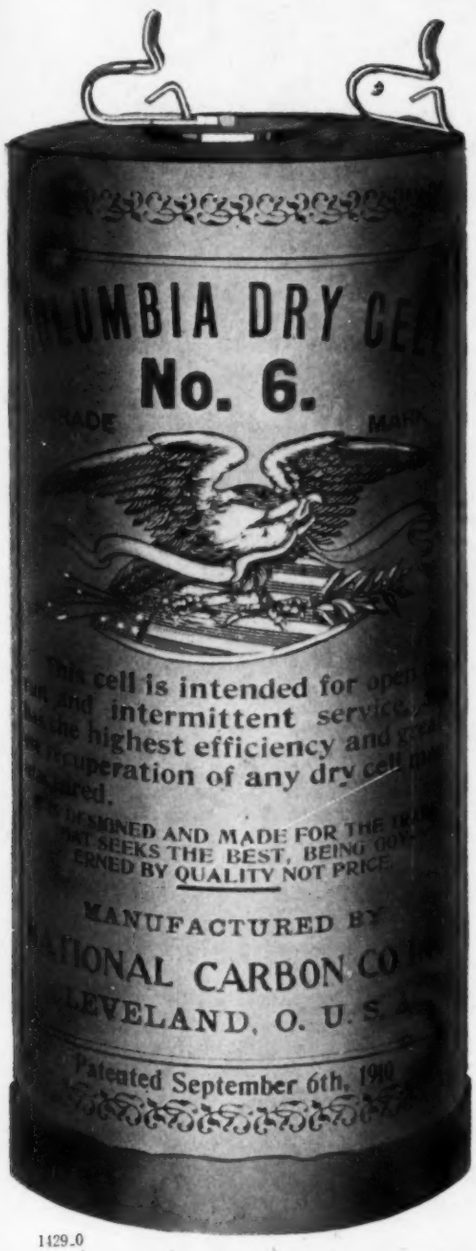
Mr. Fisher presided at the last meeting of the directors of the United States Independent Telephone Association at the LaSalle Hotel, Chicago, on Dec. 7, where he was made the guest of honor at a surprise luncheon in commemoration of his 73rd birthday. Among the speakers on this occasion were H. D. Critchfield, F. L. Beam, H. B. McMeal, Hart F. Farwell, H. Linton Reeber and C. Y. McVey. Mr. Critchfield told of the first meeting of Independents at the Palmer House, Chicago, in 1897, at which Mr. Fisher was present. He characterized Mr. Fisher as a big, broad-minded man who saw and recognized changes and acknowledged them. Mr. Critchfield nominated Mr. Fisher "as the Grand Old Man of Independent telephony" and expressed the hope that he would be active for many years to come.

In responding to these expressions of good will Mr. Fisher was visibly affected and expressed his thanks to his associates. He spoke feelingly of his long years of service in Independent telephony and the pleasure of his long association with the association. The following week he died.

Mr. Fisher married Miss Fronia Foster Rood, daughter of C. C. Rood. Of nine children seven are living: Capt. John E. Fisher, Chicago; Corp. Morris B. Fisher in the consular service, Havana; Mrs. Arthur D. Peters, Lima, Ohio; Mrs. James Madden, Bethlehem, Pa.; Mrs. Victor O. Pfeiffer, Mrs. DeWitt Davison and Miss Charlotte R. Fisher, Grand Rapids.

Columbia Telephone Cells

"less cost per day of service"



TELEPHONE MEN the world over know how the Columbia Gray Label proves the old adage that "talk is cheap." Columbias are built to make the line talk up with a snap; by reason of their long life they do it at less cost per talk, which means *less cost per day of service.* Fahnestock Spring Clip Binding Posts without extra charge.

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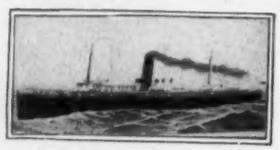
From Ocean to Ocean by Telephone

Banqueters at Waldorf Hotel New York Hear Talk from Steamer Gloucester in Atlantic Ocean to Catalina Islands

Courtesy Telephone Review.

The Gloucester, riding in the rough Atlantic, from which the skipper spoke via air, by means of wireless telephone, to shore, whence his voice was carried by the transcontinental lines to Los Angeles, California, and then via air once more to operator Spiker, on Santa Catalina Island, off shore.



Beautiful Santa Catalina, to whose shores came the voice of the skipper of the Gloucester and of Col. J. J. Carty, in New York City, clear and distinct, and from which a man replied, taking part in a conversation that marks a new era in telephony.

A NEW record of telephone achievement was made in the course of a demonstration witnessed by the members of the preliminary International Communications Conference at a dinner given them by the American Telephone and Telegraph Company at the Waldorf, New York, on the evening of October 21. They were able to talk and listen over the line of the Bell System from New York to Los Angeles, and by wireless from Los Angeles to Santa Catalina Island and eastward by wire to an Atlantic port and by wireless telephone to the steamship Gloucester at sea, and they were also able to hear people talking from the ship on the Atlantic by wireless to shore, by wire across the continent, and by wireless to an island on the Pacific.

This new feat in the art of communication, remarkable in itself, was all the more interesting because it was made in connection with the dinner given by President H. B. Thayer on behalf of the American Telephone and Telegraph Company and Associated Companies, the Western Electric Company, Incorporated, and the International Western Electric Company, which was attended by some fifty conference delegates representing Great Britain, France, Italy, Japan, and the United States, together with the principal officers of the Bell System and of the General Electric Company and its associated companies.

The Communications Conference, which has been holding sessions in Washington, took advantage of an opportunity given them by the General Electric Company and the American Telephone and Telegraph Company to inspect some of the highest developments in America in the line of electrical communication.

The party left Washington Sunday night and visited the New Brunswick, N. J., wireless telegraph station of the Radio Corporation of America on Monday, the factories of the General Electric Company at Schenectady on Tuesday, the West Point Military Academy on Wednesday, and on Thursday the general offices of the A. T. and T. Company in New York, the operating rooms of the Long Island division on Walker street, and the laboratories of the American Telephone and Telegraph company, and Western Electric Company on West street.

At the main offices of the American Telephone and Telegraph Company demonstrations were given of the cipher telegraph, of transmission through a 1,000-mile cable, and of carrier currents. At the Walker street building they inspected the long distance switchboards, the test boards and mechanical switching apparatus.

Guests of the A. T. & T. Company, who "listened in" on this side of the continent to the wireless conversation which had for its two objectives Santa Catalina Island in the Pacific and the ship, the Gloucester, in the Atlantic, are here shown at the dinner given in their honor at the Waldorf, New York. These members of the Preliminary International Communications Conference included representatives from Great Britain, Italy, Japan and America.

and at the West street building they were shown through the research and development laboratories of the Bell System and Western Electric Company, where most important work for progress in the art of communication is being carreid on.

At the dinner, which was given at the Waldorf-Astoria, they were shown a motion picture descriptive of the building of the transcontinental telephone line. They were welcomed by President H. B. Thayer, and were addressed by Col. John H. Carty, vice-president of the American Telephone and Telegraph Company, who had charge of the demonstration.

Colonel Carty spoke briefly of radio development and explained the singular advantages of the wire telephone service over land and of wireless telephone transmission in situations where wires could not be used. He referred to the wireless telephone record made by the Bell System in 1915, when wireless transmission was accomplished by engineers of the Bell System, not only across the continent, but from Washington to Honolulu and from Washington to the Eiffel Tower. In this connection he expressed gratitude for the co-operation of the navy in permitting the use of the Arlington Tower, and of the French nation in permitting the use of the Eiffel Tower, particularly of the courtesy of General Ferrie, who was in command at the Eiffel Tower, and who was present at the dinner.

Each place at the table was equipped with a receiver, and as Colonel Carty called the roll of the district chiefs along the route of the transcontinental line, the guests heard each answer and learned from each the distance from New York, the local weather conditions and the local time. As the roll was called a large map hanging on the wall was illuminated so that the course of the connection across the continent could be followed.

When the connection with San Francisco had been established, conversations were held between the British consul there and a representative of the British delegation, between the Italian consul and a representative of the Italian delegation in the Italian language, between a Frenchman and the representative of the French delegation in the French language, and there was to have been a conversation in Japanese but for the inability of the Japanese consul in San Francisco to be present.

Then the connection was carried down from San Francisco to Los Anceles, and a conversation was had with a representative of the company at Santa Catalina island. The representatives of the conference found that a communication of over 4,000 miles by wire and of 30 miles by wireless to Santa Catalina was as clear as if it had been from another part of New York City.

The connection was then established with the steamship Gloucester, which had left port four hours before, and unfortunately had not gotten far enough from land interference to make possible the best wireless results. There was also at times considerable static interference. Nevertheless the conversation between Colonel Carty and his representative on the Gloucester was clearly heard, and later, when the conversation was put through from the steamship Gloucester to Santa Catalina island, the hundred guests at the dinner were able to hear the talk from off shore in the Atlantic to off shore in the Pacific.

In behalf of the representatives of the delegates for the preliminary international communications conference, Mr. F. J. Brown, assistant secretary of the British post office, and presiding officer and senior delegate of the conference, spoke in behalf of his confreres to express their high appreciation of the marvels of the art of communication which they had been shown and of the hospitality of the

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is entering the new year with an increase in circulation of 50% over that at the beginning of last year.

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American Telephone and Telegraph Company and its Associated companies.

Representing the various European countries were the following delegates at the demonstration:

British: Mr. F. J. Brown, Major General H. K. Bethell, Mr. R. A. C. Sperling, Lieut. Col. B. Gardiner, Lieut. Col. Mackworth, Lieut. Commander E. W. M. King, Commander L. Robinson, Captain J. A. Echaverri, Mr. H .Madge, Mr. C. B. Edwards, Mr. F. W. Phillijs.

American: Mr. Van S. Merle-Smith, Mr. Walter S. Rogers, Major General George O. Squier, Brigadier General D. E. Nolan, Captain George W. Bicknell, Rear Admiral W. H. G. Bullard, Dr. Walter Wallace McLaren, Mr. W. W. Andrews.

French: M. Broin, General Ferrie, Brigadier General L. Collardet, M. Poulaine, M. de Lapradelle, Captain Franck, Lieut. Robin.

"You, Captain Nichols on the Gloucester, and Operator Spiker on Santa Catalina Island, are taking part in an epochal event in wireless telephony. You are the first men to talk to each other from the Atlantic to the Pacific, across the waters of both oceans and the stretches of the continent."

—Col. J. J. Carty, Vice-President of the A. T. & T. Company, at Atlantic-Pacific Demonstration.

Japanese: Mr. Senzaburo Kageyama, Captain Y. Uyeda, Mr. Ushigoro Kojima, Mr. Kozaburo Sugino, Commander Hattori, Major Shosuke Takagi, Mr. Toyokichi Nakagami.

From Sea to Sea

Lines written on learning that on October 21 a man spoke from the island of Santa Catalina, in the Pacific, to a man on a steamer in the Atlantic.

Little children, born beside the sea,
Soon hear its haunting song within their ears.
They build sand-castles, which the rising tides
Melt down and leave no trace, as in the years
Their builders, grow, love, labor, dream and die;
So short a span 'gainst ocean's ceaseless heart,
(Their dreams, you say, scarce held beneath the sky?)
Frail, like the sand-pipers at dusk who dart
Along the wave-swept rain-bow tinted beach.
From Catalina's shore man's voice did reach
Last night. O'er sea and mountain snows it passed
O'er river, plain, and city's din, at last—
Atlantic surf—to the horizon's rim
Where one who listened, heard, and answered him!

—Sarah Atherton Bridgman.

Italian: Commandatore N. Mirabelli, Colonel Marquis Vittorio Asinari di Bernezzo, Colonel Bardeloni, Commander Raineri Biscia.

Women and Electricity

When a woman is sulky and will not speak—Exciter.

If she gets too excited—Controller.

If her way of thinking is not yours—Concerter.

If she is willing to come half way—Meter.

If she is willing to come all the way—Receiver.

If she becomes quarrelsome—Dispatcher.

If she wants to be an angel—Transformer.

If she wants chocolates—Feeder.

If she sings wrong—Tuner.

If she is in the country—Telegrapher.

If she is a poor cook—Discharger.

If her dress unhooks—Connector.

If she eats too much—Reducer.

If she is wrong—Rectifier.

If she is cold to you—Heater.

If she gossips too much—Regulator.

If she fumes and sputters—Insulator.

If she becomes upset—Reverser.

KANSAS CONVENTION.

The annual meeting of the Kansas Independent Telephone Association will be held at the Lamer Hotel, Salina, Kans., on February 1 to 3. A good program and varied entertainment is promised for the three days meeting.

Telephone Service

The Public Has Been Educated to Good Service and Telephone Companies Bend Every Effort to Give It

By MISS MYRTLE MATTHEWS

THERE are five things that are connected with the word Service. They are courtesy, accuracy, attendance, efficiency, and co-operation.

We take up courtesy. It is something which the public has a right to expect. It makes work easy and pleasant, encourages the use of the service, and is profitable both to the employe and the company. Discourtesy wastes time, creates difficulties, and causes dissatisfaction. In telephone communition impressions are formed entirely from what is said and the manner in which it is said. A courteous tone and expression are more necessary in telephonic communications than in face to face conversations. In the latter case, the smile, the gesture and the facial expression serve to smooth and soften the spoken words, whereas, in the former, there is nothing from which to judge the temper of the speaker except the actual words, the intonation and the inflection.

Mistakes are usually caused by carelessness. They result in failure to give the service expected, annoyance to the patron, in wasted work on the part of the employes and in unnecessary expense to the company, all of which may be avoided by reasonable care.

Facilities are furnished by the company to give prompt and efficient service under normal conditions. That desired results may be secured it is essential that every employe perform each step in the fork with reasonable dispatch. Speed is not mere haste, but is the quiet and orderly performance of each act, without loss of time and with the least expenditure of energy. Uniformity in speed of service is most desirable. One case of slow service affects the good impression created by many cases of fast service. All dealings with patrons and other employes should be conducted without waste of time and in a brisk and business like manner, but with the utmost courtesy.

It is very necessary that you should be regular in attendance and report punctually at the hours assigned. If you are obliged to be absent, obtain permission in advance if possible. If your absence is unexpected, see that the manager is notified by telephone if possible, before the hour at which you should report for duty. Reports should be made each day of illness unless you can furnish definite information as to the probable length of service.

While you are in the building you are expected to conduct yourself in a quiet and orderly manner; while on duty in the operating room, you should hold no conversation with other operators or subscribers beyond that necessary for the proper performance of your work. Carry on any necessary conversation in a low tone of voice.

The last thing connected with service is co-operation. The satisfactory completion of a telephone call requires the co-operation of several persons. The failure of one employe to perform properly her part of the work reacts seriously on the efforts of others. Good and efficient service requires able team work to the fullest extent, both in fact and in spirit.

—Telephone Review.

No. 522

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"MADE IN AMERICA"
LOUIS STEINBERGER'S PATENTS

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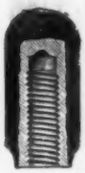
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ELECTROSE Insulation has been the Quality Standard for 20 years.

ELECTROSE Products: Receiver Shells and Caps, Mouthpieces, Connecting Strips, Jack Panels, Knobs, Handles and all forms of special insulating parts.

Safety Strain Insulators, Line Insulators and all other types of Insulators for use in connection with telephone lines, transmission lines, electric railways, etc., etc.

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ECCO Dependable Telephone WIRE

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No. 5 BRAIDING

THE above picture shows how Ecco telephone wire is covered with the outside protective braid. The machines here shown are of the most modern high-speed type, and exemplify another point of ECCO efficiency that has placed their products among the leaders of the industry.

A complete stock of Ecco Telephone Wire is carried by
KELLOGG SWITCHBOARD AND SUPPLY COMPANY
Chicago, Columbus and Kansas City

Manufactured by
THE ELECTRIC CABLE COMPANY
YONKERS, NEW YORK

No. 46 Cradle Set

MAGNETO AND COMMON BATTERY

No. 46 Telephone

Makes Telephoning a Pleasure and Convenience

Use One Hand Only for Holding Light Weight Hand Set.

Transmitter is always in right position for talking. Supply your subscribers with these up-to-date sets.

No. 17 Hand Set

No. 17 Hand Set makes an attractive and practical instrument for extension telephone or for use in place of standard transmitter and receiver on wall phone.

Full Information and Prices Upon Request

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Copper, Tinned Copper and Steel

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Sleeves that make the splice as strong as the wire itself.

Sleeves that are manufactured and inspected to meet the standard specifications of the largest telephone and telegraph companies.

Every sleeve that is shipped from our factory is guaranteed to pass inspection under these most exacting specifications.

Reliable Electric Company

3145 Carroll Ave. Chicago, Ill.

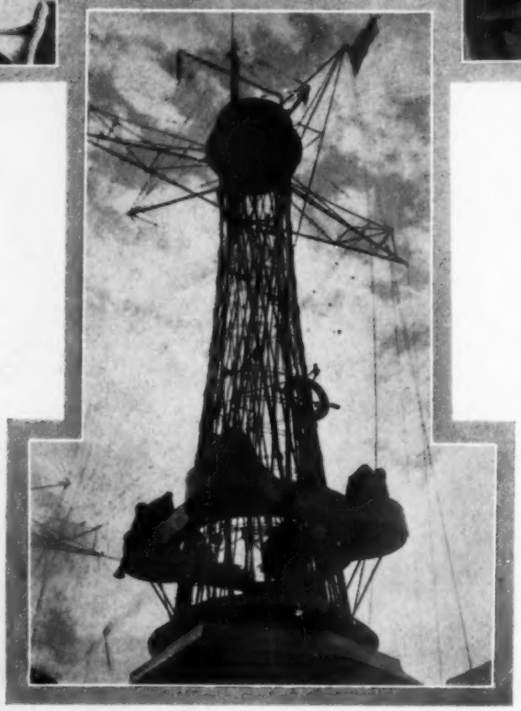
Singing to the Pacific Fleet by Wireless Telephone

Admiral Hugh Rodman, in his cabin aboard the Pacific Fleet Flagship New Mexico, listening in while Miss Burch sings by wireless telephone. Even the Admiral's pet is enjoying the first wireless telephone concert.

In the illustration below is shown Rear Admiral N. G. Twining, Chief of Staff of the Pacific Fleet, listening in while Miss Burch sings by wireless telephone to her brother at sea.

OFFICIAL BUSINESS OF PACIFIC FLEET "OFF" WHEN PRETTY GIRL SINGS INTO WIRELESS TELEPHONE.

Photos by International.



Miss Mabelle Burch (above). Brilliant young colerature who received permission to sing to her brother Carleton on the Submarine F-2, by wireless telephone. The entire Radio force and officers of the Pacific Fleet "listened in."

To the left is shown main mast of one of the latest dreadnaughts of the Pacific Fleet. Showing wireless telephone equipment through which Miss Burch sang to the Radio force and officers, through permission of Admiral Rodman.